

Personal Computer

Middleton - FAIRWINDS
Bestella
(103)

SHARP
PC-3201
BENCHTESTED

Canada \$2.75/US \$2.00/FF 8.80/FL 4.00/SFr 7.20/IR £1.04/
BFr 87/SKr 13.55/DKr 21.00/NKr 13.70/Lire 3000/DM 5.50

World

July 1981 75p

EUROPE'S LEADING MICRO

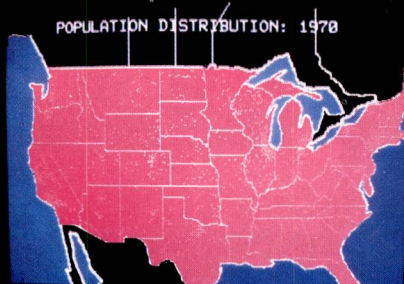
MAGAZINE



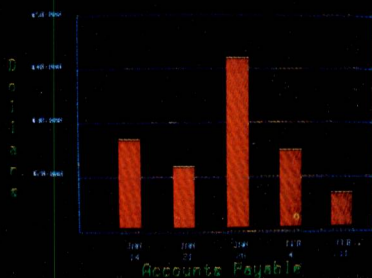
**'I WAS PROCEEDING IN A NORTHERLY DIRECTION...'
Accident research: TRS-80 picks up the pieces.**

MicroCentre introduce

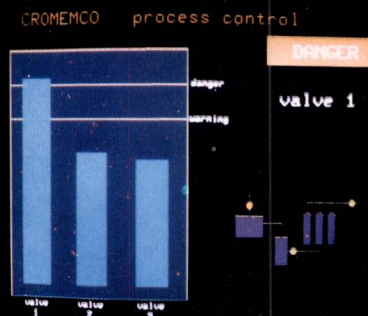
High Resolution Graphics



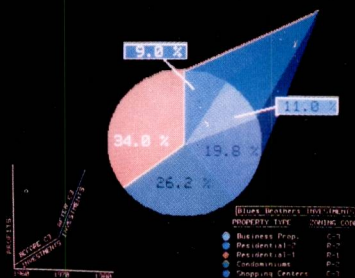
Demographic Display



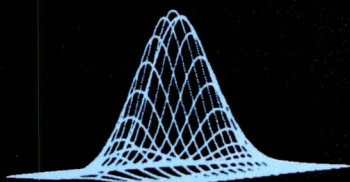
Management information



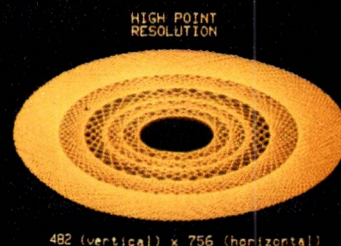
Control system display



3-D display with angled labels



3-D plots



High-resolution display with alphanumerics

Up to 16 colours can be displayed simultaneously, from a choice of 4069. Areas can be filled with colour, windows created, graphs plotted, etc—all under control of simple Basic, Fortran or Assembler functions.

At the heart of any Cromemco graphics system is Cromemco's "SDI" board, the most versatile video interface in the microcomputer industry today. The Cromemco SDI is designed to meet the challenge of professional and industrial environments where uncompromising performance, reliability, and continued compatibility are essential. With its high point resolution, colour map selection, dual page windowing function, automatic fill mode, and NTSC or PAL broadcast compatibility, the most demanding requirements for a video interface can be met. The SDI provides a choice of 4096 individual colours and up to 754 by 482 point resolution. Its different modes of operation include bit or nybble mapped displays with varying levels of resolution, and window effects requiring as little as 12k data storage.

RGB-13 Colour Monitor

The Cromemco RGB-13 Colour Monitor has been specially designed for optimum colour graphics performance when used with Cromemco's SDI video interface. It includes a fine-pitch 13" CRT with a high-precision electron gun, internal magnetic shielding, and implosion protection band. The monitor combines alphanumeric character generation with colour graphics and

high resolution, to give an overall performance vastly more superior than conventional colour TVs or CRT terminals.

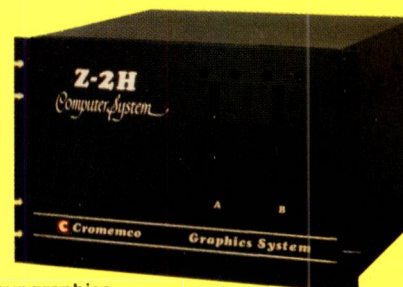
Graphics Software

Cromemco's graphics software package provides an interface to Fortran IV, Ratfor, Macro Assembler, 16K Extended Basic and 32K Structured Basic. It is written for ease of use and takes full advantage of the RGB-13 monitor's special graphics facilities. Thus it is efficient, flexible and extremely fast. The package contains routines to change the colour map, scale the display area, draw dots, lines and circles, display text, and fill areas with colour. Screen addressing can be by absolute or relative co-ordinates.

Model Z2H/GS Graphics System

The Z2H/GS is a special configuration of the Z-2H Hard Disk computer which includes full graphics capability and software. Yet at under £8,000 it's a fraction of the cost of comparable systems. It is ideal for applications in medical imaging, computer-aided instruction, pattern recognition, and the television industry.

The Z2H/GS includes a Z-80A processor, 64k of RAM memory, integral 11 megabyte hard disk, RGB-13 colour monitor, 2 floppy disks, printer interface, RS-232 serial interface, and graphics software package.



The high-performance Z2H/GS colour graphics system includes a Z-2H hard disk computer, RGB-13 colour monitor, and comprehensive graphics software package—all for under £8,000!

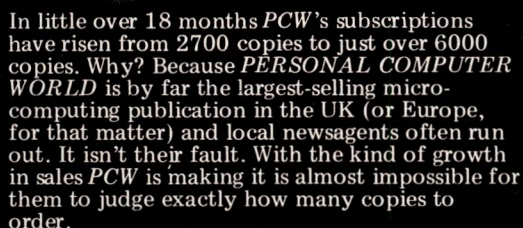
For Cromemco... call the experts

MicroCentre
Tel: 031-556 7354

LEADING UK
DISTRIBUTORS

Complete Micro Systems Ltd.,
30 Dundas Street
Edinburgh EH3 6JN

SUBSCRIBE TO PCW



SUBSCRIPTION ORDER FORM

Please start my subscription from the _____ issue.

- Name _____

Address

[illegible]

For Office use only

	a			b			c		d					e
--	---	--	--	---	--	--	---	--	---	--	--	--	--	---

PCW 1

ANY TIME NOW IT WILL BE WORTH BUYING A HOME COMPUTER.

You haven't seen a real home computer until you've seen the VIC 20 by Commodore.

But by August you'll get your chance.

Because that's when the first VIC 20's will be arriving at your Commodore dealer.

Then you can take a good, long look at what makes VIC the best.

Like the real typewriter keyboard with full graphics. And eight background

and 16 foreground colours. And music in three voices and three octaves, as well as language and sound effects.

So don't think of buying a home computer until then.

Because it simply isn't worth it.



commodore
COMPUTER

Commodore Home Computer Division, 818 Leigh Road Trading Estate,
Slough, Berks. SL1 4BD. Telephone: Slough (0753) 74111.

INSIDE PCW

Volume 4 No 7 July 1981



Cover illustration David Scutt

50 NEWSPRINT:
Guy Kewney's usual idiosyncratic view of the news.

58 YANKEE DOODLES: Tom Williams reports from California.

59 PCW SHOW:
The latest news of our own show.

61 CTUK! NEWS:
Yes, even more ComputerTowns have opened!

62 COMMUNICATIONS: Your chance to have your say.

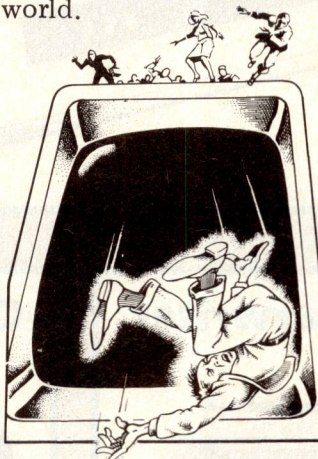
65 BENCHTEST:
Another Japanese newcomer, the Sharp PC-3201.

68 MICRO CHESS:
With our resident chess expert Kevin O'Connell.

70 COMPUTER GAMES: David Levy turns East to look at shogi.

74 COMPETITION:
Positively your last chance to win a DAI computer.

78 BANKS' STATEMENT:
Introducing Martin Banks, with his own insight into the micro world.



80 MULTI-USER BENCHTEST:
Sue Eisenbach and Chris Sadler test Acorn's Econet.

87 SECRETS OF SYSTEMS ANALYSIS: Lyn Antill guides you through the horrors of implementation.

90 CASE STUDY:
Tom Ravensdale uses his TRS-80 to investigate road accidents.

96 COMPUTER ANSWERS:
Sheridan Williams and his team answer your queries.

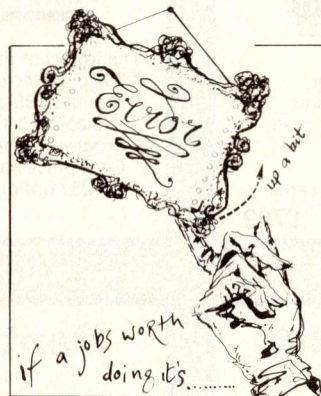
99 ZILOG'S Z8 FAMILY:
A look at an interesting group of microprocessors.

103 YOUNG COMPUTER WORLD: Especially for our younger readers.

104 PATTERNS:
Alan Sutcliffe continues his series.

110 BACK ISSUES:
What you've missed.

112 BOOKFARE:
Malcolm Peltu reviews structured programming books and the ZX81 manual.



116 UP THE SHARP END:
Mike Knight on how to deal with 'computer people'.

119 WORD PROCESSOR BENCHTEST: Format-80 on the Apple II.

126 PASCAL — READERS WRITE: More feed-back on our Pascal Benchmarks.

129 CALCULATOR CORNER: Dick Pountain describes quicker Casio computation.

133 NEWCOMERS START HERE:
Our quick intro for those new to micros.

134 DIRECT ACCESS: including Packages, a bumper Transaction File, User Groups Index, ComputerTowns, Diary Data and Network News.

143 PCW SUB SET:
More useful machine-language sub-routines.

146 LEISURE LINES:
Stretch your micro with J J Clessa.

147 PROGRAMS:
More listings from our mailbag.

158 BLUNDERS:
Our monthly confession.

199 CHIP CHAT:
Europe's leading microgossip page.

Founder
Angelo Zgorelec

Editor
David Tebbutt

Deputy Editor
Peter Rodwell

Sub Editor
Jon Wall

Art Director
Paul Carpenter

Art Editor
Shelley Gray

Production
Manager
Dick Pountain

Typesetter
Jane Hamnell

Advertisement
Director
Stephen England

Assistant
Advertisement
Manager
Patrick Dolan

Advertisement
Executives
Margaret Burton
Jacquie Hancock

Subscriptions
manager
Alexandra James

Subscription rates
UK: £10.00
Overseas: £17.00

Address
14 Rathbone
Place, London
W1P 1DE

Please note our
new phone
number for all
departments:
01-631 1433

Published by
Sportscene
Publishers (PCW)
Ltd, 14 Rathbone
Place, London
W1P 1DE, England.
Tel: 01-631 1433
Telex: 8954139
BUNCH G London
Copyright notice
Personal Computer
World is published
by Sportscene
Publishers (PCW)
Ltd. © 1981 Felden
Productions. No
material may be

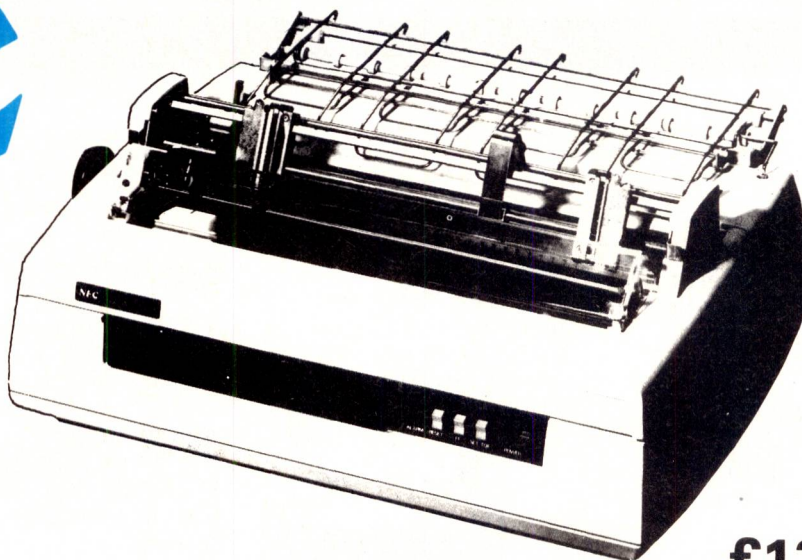
reproduced in whole
or part without
written consent
from the copyright
holders

Printed by Riverside
Press, Whitstable
Distributed by
Seymour Press
334 Brixton Road
London SW9
Tel: 01-733 4444

ABC

The Printer People

NEC

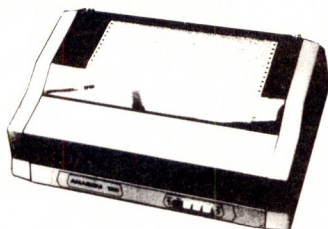


The word-processing printer

- * Letter quality for word-processing
- * 128-character standard 'thimble'
- * 55 chars/sec — friction/tractor feed
- * Up to 5 copies; single-sheet option
- * Five models available, including RS232 or Centronics parallel interface versions

from
£1350

Anacom 150

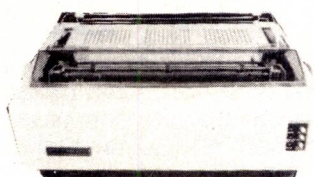


The reliable commercial printer

- * 150 chars/sec, 136 columns/line
- * 9x9 matrix, upper and lower case
- * Up to 15" paper width
- * Full forms control
- * Centronics parallel or RS232 serial

£799

TEC Starwriter

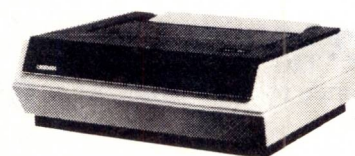


The low-cost daisywheel printer

- * 25 cps letter-quality output
- * Standard 96-character daisywheels
- * 136-column/15" print width
- * Programmable forms handling
- * Centronics parallel interface standard
- * RS-232 option

£999

OKI Lineprinters



High reliability Slimline lineprinters

- * Print speeds from 125 to 300 lines/min
- * Full 132 columns
- * 12 program-selectable fonts
- * Built-in diagnostics, self-test features

SL125/160, SL250/300 from **£1799**

TVI terminals

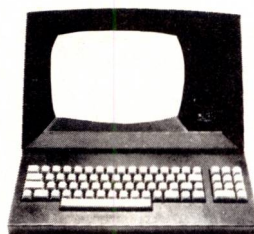


Full range of intelligent units

- * 24x80-character display
- * Full upper/lower case ASCII
- * Separate numeric keypad
- * Smooth scrolling on 950 version
- * Wide range of editing functions

Models 910, 912C, 920C, 950
from **£425**

Pentland VI

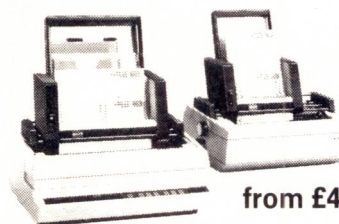


A British smart terminal

- * Full ASCII character set
- * Numeric keypad
- * Green anti-glare screen
- * Reverse video, full cursor controls

Model VI **£449**

Automatic sheet feeders



from **£450**

For complete word-processing

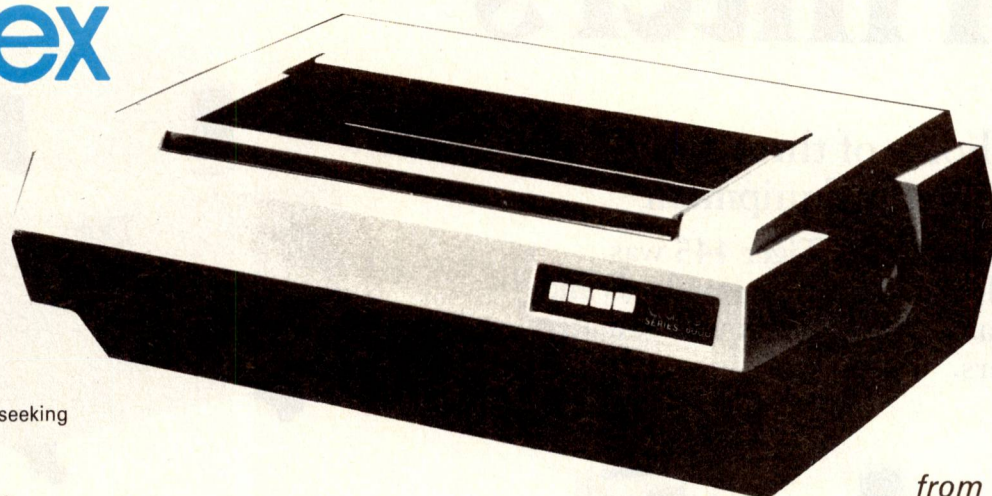
- * Feeds letterheads, multipart sets
- * Up to 250 sheets
- * No software required
- * Optional twin-tray envelope feed
- * Versions for NEC, TEC, Qume, Ricoh, Diablo and others

Phone 0372 62071

Qantex

6000 / 6010 series

- * 150 characters per second
- * Up to 136 columns per line
- * Bidirectional printing, logic-seeking
- * 9x9-dot matrix
- * Standard ribbon cartridge
- * Centronics parallel or RS232/20mA serial interfaces
- * X-ON / X-OFF control
- * 2K or 4K buffer available



from
£775

Centronics 737

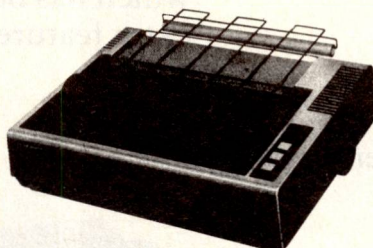


Letter quality printer

- * 7x9 and 12x9 dot matrix
- * 3-way paper handling, up to 8 1/2"
- * Up to 80 characters/second
- * Centronics parallel standard; RS232/20mA serial option

£349

Epson

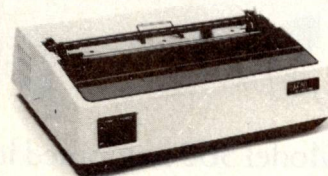


Complete range of interfaces

- * ASCII and graphics characters sets
- * Bold, expanded, condensed print
- * Centronics parallel interface standard

MX70T
MX80T MX80FT
MX100FT from **£259**

OKI Microlines



The quiet workhorses

- * ASCII and graphics characters
- * Condensed, double width print
- * Friction, tractor or pin feed
- * Rugged, quiet and reliable
- * Centronics parallel/RS232 interfaces

Microline 80 £295
Microline 82 £399
Microline 83 £699

Tymac products for Apple

Parallel printer board £69

Universal Centronics-compatible printer board, suitable for Epson, OKI, Starwriter, NEC Spinwriter and many other printers. **Complete with cable and connector** for Apple computers.

Super Pix screen dumper for MX-80 £25
Use with Parallel Printer board to print out full Apple HiRes graphics on an Epson MX-80 series printer

Double DOS plus £25
Allows free intermixing of DOS 3.2 and DOS 3.3 programs. Piggyback board plugs into disk controller card.

Convert your Epson MX-series tractor printer to friction/pin feed

A neweasily fitted conversion kit for your MX70-T or MX80-T tractor-feed printer, to allow you to print on single sheets and letterheads as well as standard-width tractor-feed paper.

Our price £49

Realistic DEALER,
OEM and EDUCATIONAL
DISCOUNTS OFFERED —
please phone 0372 62072
for details.

NORTHAMBER
*Importers, Distributors
and Wholesalers*

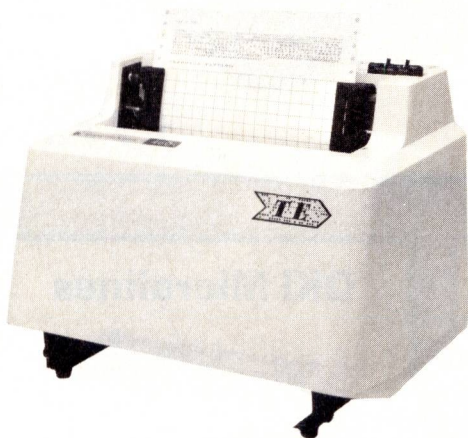
Great Oak House,
Esher, Surrey, KT10 9BR
Phone: ESHER (0372) 62071

*Full details on request
All prices quoted exclude VAT*

Paper Tiger matrix printers

— a choice of three from
Teleprinter Equipment

When the Paper Tiger 445 was introduced, it set new standards and new sales records for low cost matrix printers.



Now Model 560 has joined its brothers to form an unbeatable trio.

Model 560 has all the 460's advantages — like a staggered wire matrix head, bi-directional logic-seeking device and a host of print optimisation features — plus the ability to print 132 columns on full width paper.

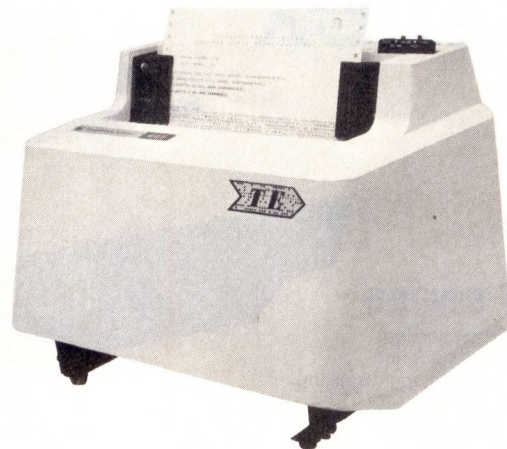
So whatever your application there's bound to be a Paper Tiger which will devour your problems.

Send the coupon to us using our Freepost service for full details on all three models.

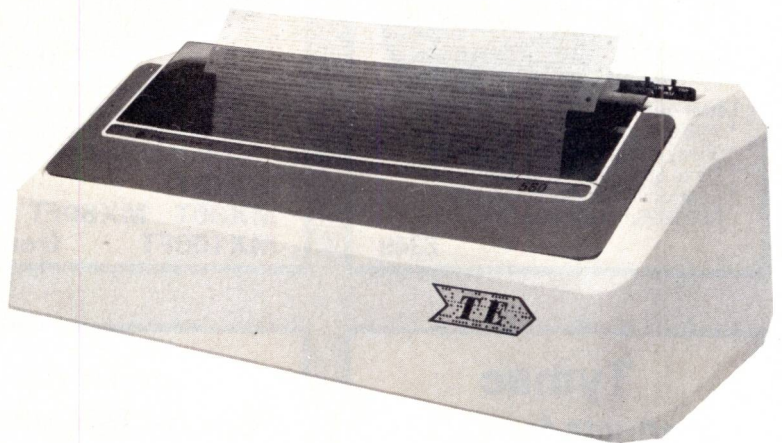


Teleprinter Equipment Limited —
the peripheral people

70-82 Akeman Street, Tring, Herts. HP23 6AJ. U.K.
Tel: Tring (0442 82) 4011/9 & 5551/9.
Telex: 82362 BATECO G.



It was soon joined by the Model 460 which has no less than ten desirable extra features.



Please send me details of Paper Tiger 445 ☐
460 ☐
560 ☐
All ☐

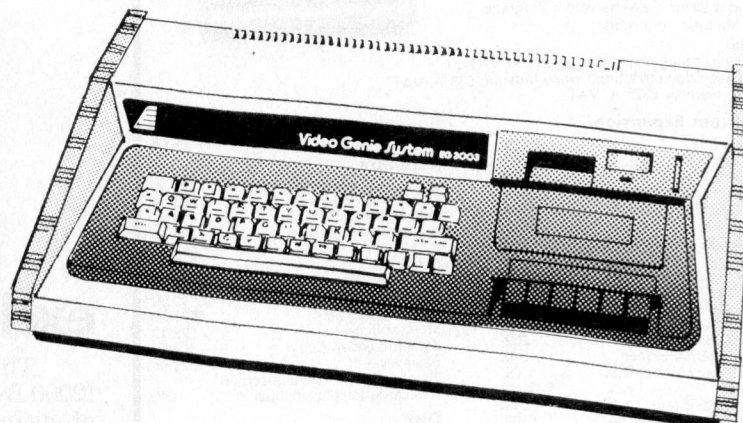
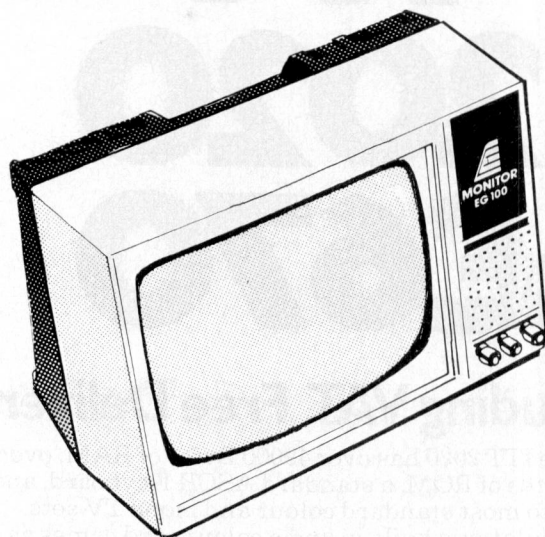
Name

Company

Address

Telephone

Affordable Expandable Available



video genie system

Features

16K RAM, expandable to 48K
12K Microsoft BASIC in ROM
TRS-80 Level II software compatible.
Plugs directly into a 625 line TV.
Connects to second cassette recorder.
Video output for monitor.
Completely self-contained. Easily portable.
Expandable to include 4 disk drives
S100 bus available
Now with VU meter
Including 4 cursor control keys
Wide range of accessories available.

Guide Prices

Video Genie EG3003	£325.00
Expander box (incl RS232)	£225
Expander Box	£195.00
EG100 12" monitor	£69.00
16K S100 RAM card	£100.00
32K S100 RAM card	£140.00
9" B/W high quality monitor	£85.00
9" Green phosphor monitor	£95.00
Single disk drive	£225.00
Dual disk drive	£440.00
Technical Manual	£5.00
Programming Guide	£5.00

All prices exclude VAT (if applicable)

The VIDEO GENIE SYSTEM offers outstanding value for money : a complete system with Microsoft BASIC, 16k of RAM and internal cassette, ready to use for just £325.00 plus VAT. Including full manuals, interconnecting leads and a demonstration tape.

The System is easily expanded to a full 48K twin disk Business System, including printer, monitor and cables for around £1500 plus VAT. Value indeed!

The System is available nationwide — for full details and a list of dealers contact Lowe Electronics

LOWE ELECTRONICS

CHESTERFIELD ROAD, MATLOCK, DERBYSHIRE TEL 0629 2430/2817



Video Genie

**BRITAINS' BEST BUY
IN PERSONAL COMPUTERS?**

£279
+ VAT

**Latest version with
Vu-meter and extra Keys**

- 16k Ram, + 12K Microsoft Basic in Rom
- TRS80, Level II Compatible
- 100's of Programs Available
- Self-Contained Power Supply
- Integral Cassette, Plugs into TV or Monitor
- Ideal for Business, Education + Leisure
- Includes Demo Cassette with 5 Programs, + 3 Manuals, and leads



Options:

Sound Unit, fitted when ordering £15 + VAT
Lower Case Characters fitted when ordering £38 + VAT
With 32K memory £325 + VAT

VG System Expansion

Expansion Box	£189
Floppy Tape ACCULAB	£168
Single Disc Drive	£210
Disc Drive TEAC FD-50A	£140
Double Disc Drive	£389
Light Pen	£116
Seikosha GP/80 Printer	£195
Epson MX-70 Printer	P.O.A.
Epson MX/80 Printer	P.O.A.
Centronics 737 printer	£349
Printer Interface (CENTRONICS)	£35
S100 RAM Card 32K	£129
Monitor 9" B/W Screen	£69
Monitor 12" B/W Screen	£70
Green/Amber Monitor Filter	£9
Joy-sticks	P.O.N.
Colour (fitted) Board	£49
Colour monitor uncased 14"	£199
RS232 Interface	£50
EPROM Programmer	P.O.A.

Books

Cassettes C12	£10.45
Expansion Box plus 32K	£289
TRS-80 Interfacing Book 1	£7.95
TRS-80 Interfacing Book 2	£6.95
TRS-80 Disk Mysteries	£14.95
TRS-80 Machine Language	£8.50
S100 Bus Handbook	£9.15
CP/M Handbook	£8.95

VG Service Manual	£5.95
TRS-80 Basic	£5.95

Software

Space Invaders with Sound	£13.00
Music Master with Sound	£14.95
Pinball with Sound	£13.00
Android Nim with Sound	£9.50
Z Chess III	£14.50
Saragon II	£22.50
Stock Control	£17.00
Word Processor	£19.50
Editor Assembler +	£21.70
Monitor Imon	£23.10
System Loader/Copy	£8.50
Basic level III	£29.95
Teach yourself machine code-6 cassettes plus manual	£49

Disc

Newdos Plus	£45
Pascal	£59
Newdos 80	£75
Verbatim 5 1/4" Disc 10 for Soft Sector	£19.50

Kits

Colour Kit	£39
Lower Case	£34
Sound Unit	£10
Keyboard Up Grade	£6
IGK Memory Upgrade Board	£45



EPSON MX-80

**80 COLUMN DOT MATRIX
PRINTER** one of the worlds
most advanced printers. Pinfeed
and pinfeed/friction versions
available.



Sofy

INTELLIGENT EPROM PROGRAMMER

Built or Kit form
Connects directly to TV, will copy
burn, verify 2780, 2716, EPROMS
KIT £99 BUILT £120, Power supply £20 ALL + VAT

Best Memories

	1+	100+
2708 Eproms	£1.75	£1.50
2716 Eproms	£2.60	£2.45
2732 Eproms	£7.45	£6.99
2532 Eproms	£7.45	£6.99
2114 Rams 200ns	£1.85	1.60
4116 Rams 200ns	£1.60	£1.45
6116 16K Static		£13.00

Character Generator

RO/3/2513 U.C.	£4.50
SN74S262	£9.75

Sound Generator Chip

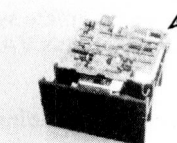
AY-3-8910	£6.45
-----------	-------

Eprom Eraser

Low cost eraser	£36.00
-----------------	--------

All + VAT

TEAC FD-50A 5 1/4" DISC DRIVES Uncased



£140 +
VAT =
£150 p/p

BUILT
£150 + VAT
+ £1.50 p/p

ACORN ATOM



To use the ATOM immediately you just connect the
plug to the power supply and cable into an aerial
socket of TV. ACORN ATOM built 8K, 2K RAM £150
+ VAT, Power supply £10.20 + VAT.
Includes cassettes with programmes.

Q-Tek Systems Ltd

Send 50p for Latest Catalogue
Please add VAT to all items

2, Daltry Close, Old Town,
Stevenage, Herts Tel: (0438) 65385



Order Under £50
Add 50p p + p
Otherwise carriage at cost

48K ITT 2020 £670

excluding VAT. Free Delivery.

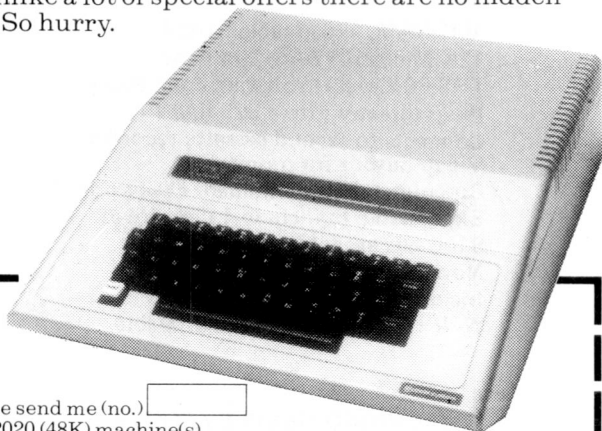
The ITT 2020 has over 49000 Bytes of RAM, over 12000 Bytes of ROM, a standard ASCII Keyboard, and plugs into most standard colour and mono TV sets. (TV modulator is built-in and a colour card comes as standard - other systems charge extra for these). The 360 Pixel specification ensures high resolution graphics and there is a huge variety of software available using Basic and Hex, (list sent on request).

In shops it could cost over £150 more but, selling by mail, we make savings we're happy to pass on.

The price, however, is all we cut - we still guarantee safe delivery and we still stand behind the machine with our full twelve-month warranty.

While the ITT has a great reputation for reliability, we still offer maintenance after the guarantee expires - and we don't expect you to return the machine for service at your expense.

Unlike a lot of special offers there are no hidden extras. So hurry.



Please send me (no.)
ITT 2020 (48K) machine(s).
Please send me details and prices of
software and peripherals. ☐

Name

Address

Telephone:

I enclose cheque for (£770.50 for each machine
including VAT of £100.50)

Please charge my Access/Barclaycard (delete as applicable)

Number

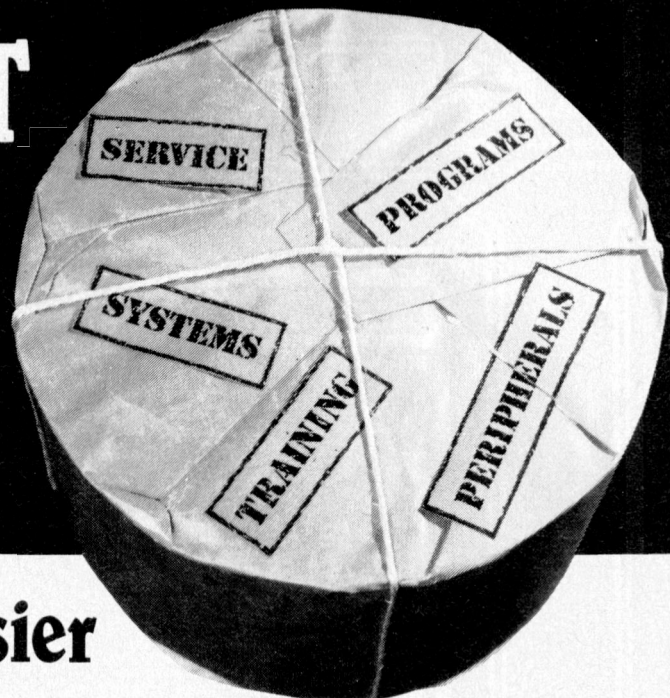
or telephone your credit card order during office
hours on High Wycombe (0494) 40262



Signature

Mail to: Currys Micro Systems Ltd., 653 London Road,
High Wycombe, Bucks. HP11 1EZ. Please allow 28 days for delivery.
Free delivery only in mainland UK. Offer invalid after December 31st, 1981.

THE PETALECT ALL-ROUND COMPUTER PACKAGE



Makes the choosing easier

We realise that with any microcomputer purchase the back-up support and advice must figure large in your decision making. A bargain price does not always guarantee a worthwhile purchase. So before deciding look at what Petalect can offer.

First time user

A modern microcomputer need hold no terrors for the first-time user. Petalect can make it easy by discussing your requirements and advising you on the most cost-effective system. And if you're still unsure you can come along to our showroom and try out a computer for yourself. We will also give your staff the necessary training FREE of charge, in other words take the headache out of modernising your business.

4 Petalect packages

Ranging from £1,000 to £15,000 the systems are amazingly simple to operate, superb value for money and are all widely used by businessmen and professionals. You'll find that all the systems software programs cover most business requirements, from accounts, to letter writing. And if you want a program specially written — we'll do that for you.

COMMODORE Ideally suited for the small business, tackling your bookkeeping, stocktaking, word processing this system is reliable and good value.

APPLE This popular computer system is one of the most versatile on the market with an expandability

up to 48K bytes of user memory space, supported by a large range of programs.

ACT The Series 800 offers the user a larger capacity system and a high speed data retrieval allowing you a higher volume of transactions.

HEWLETT PACKARD This lightweight (only 20lbs) portable computer provides the professional with a numeric or graphic system fully integrated with display screen and printer in the one unit.

Extending your system

Whichever system you choose Petalect can advise you on expanding your present capability with extra memory space or multi-terminals.

Keeping you going

However reliable your system may be, there will be times when service is required. We offer a very reliable after-sales service if you are situated in the South. Our engineers would be with you in a very short space of time reducing downtime to the minimum. And it doesn't stop there! We can offer sales support with an extensive range of computer related products — and its all just a phone call away.

Buying your system

Even here we can make it easier for you with very attractive leasing or lease purchase agreements.

So before you make a decision it makes sense to speak to us first and have the benefit of an all-round package.



PETALECT
MICROCOMPUTERS

Make the right choice,
right from the start

Showroom: 32 Chertsey Road, Woking, Surrey GU21 5BG.
Telephone: Woking (04862) 63901/68497



Please send me details of Petalect's ALL-ROUND Computer Package and price list.

Name _____

Company _____

Position _____

Address _____

POST TODAY!

Petalect Electronic Services Ltd., Dept. PCW, 33/35 Portugal Rd., Woking, Surrey GU21 5JE

MPI

MICROCOMPUTER PRODUCTS
INTERNATIONAL LTD.

LP ENTERPRISES

EUROPE'S LARGEST SELECTION OF MICROCOMPUTER SOFTWARE, BOOKS AND MAGAZINES FOR THE HOBBYIST, EDUCATIONALIST, PROFESSIONAL AND RETAILER

BOOKS

BY OSBORNE

Introduction to Microcomputer Series
Vol 0: Beginners Book £5.95
Vol 1: BASIC Concepts £8.25
Vol 2: Some Real Microprocessors £18.95
Vol 2: Updating supplement set Nos. 1-6 £18.95
Vol 3: Some Real Support Devices £11.95
Vol 3: Updating supplement set Nos. 1-6 £18.95
1 Updating supplement (Specify for Vol 2 or 3) £4.00

PET and the IEEE 488 (GPIB) Bus £9.95
6800 Programming for Logic Design £6.30
8080 Programming for Logic Design £6.30
Z80 Programming for Logic Design £6.30
Z80 Assembly Language Programming £10.75
Z8000 Assembly Language Programming £13.50
6502 Assembly Language Programming £10.75
8080A/8085 Assembly Language Programming £7.95
6800 Assembly Language Programming £7.95
6809 Assembly Language Programming £12.25
Accounts Payable and Accounts Receivable £13.50
Payroll with Cost Accounting £13.50
General Ledger £13.50
Some Common BASIC Programs £8.95
Practical BASIC Programs £9.25
8089 I/O Processor Handbook £4.50
The CRT Controller Handbook £4.50
The 68000 Microprocessor Handbook £4.00
Apple User's Guide £TBA
CP/M User's Guide £TBA
16 Bit Microprocessor Handbook £13.25
8086 Book £11.25

GENERAL

See Magazines and Subscriptions! £7.90
Microprocessors from Chips to Systems £10.60
Microprocessor Interfacing Techniques £8.95
IC OP-AMP Cookbook £4.25
RTL Cookbook £4.25
Circuits Circuit Cellar £5.50
Buyers Guide to Microsoftware £2.40
Calculating with BASIC £4.95
Computer Programs that Work (in BASIC) £3.95
Dr Dobbs Journal Volume 1 £13.95
Dr Dobbs Journal Volume 2 £13.95
Dr Dobbs Journal Volume 3 £13.95
Best of Byte £8.95
Scelbi BYTE Primer £8.95
Best of Creative Computing, Vol 1 £6.95
Best of Creative Computing, Vol 2 £6.95
Program Design £4.25
Programming Techniques: Simulation £4.25
Numbers in Theory and Practice £5.50
PIMS—A Database Management System £6.50
Best of Interface Age—Software £9.95
Programming the Z8000 £10.55
CPM Handbook £9.45
K2 FDOS £13.95

Microsoft BASIC University Software Inc., Listings: £15.00
Home and Economics Programs £20.95
Education and Scientific Programs £29.50
Small Business Programs

FOR THE Z80

See Osborne Books! £3.25
Z80 Instruction Handbook (Wadsworth) £10.05
Programming the Z80 (Zacs) £9.30
Z80 Software Gourmet Guide and Cookbook £10.10
32 BASIC Programs for the TRS-80 (Level II) 16K £4.50
Introduction to the T-Bug (Guide to TRS-80 Machine Language Monitor) £6.95
30 Programs for the Sinclair ZX80 £7.50
Z80 Microcomputer handbook

FOR THE 6800

See Magazines and Subscriptions! £7.15
6800 Software Gourmet Guide and Cookbook £3.95
6800 Tracer—An aid to 6800 Program Debugging £5.75
Tiny Assembler £15.95
RA 6800 ML—An M6800 Relocatable Macro Assembler £5.50
Link 68—An M6800 Linking Loader £3.50
MONDEB—An Advanced M6800 Monitor Debugger

CONCERNING LANGUAGE

A Practical Introduction to PASCAL £3.95
The PASCAL Handbook £10.05
Beginners guide to UCSD PASCAL £7.50
Introduction of PASCAL (Including UCSD PASCAL) £9.10
BYTE Book of PASCAL £16.25
SCELBAL—BASIC Language Interpreter (Source Code) £10.00
Instant BASIC £7.50
BASIC BASIC £6.50
Advanced BASIC £6.00
Users Guide to North Star BASIC £10.00
Microsoft BASIC (a guide) £6.50
Secret Guide to Computers £4.00
Fifty BASIC Exercises £9.10

FOR THE 6502

See Magazines and Subscriptions! £5.50
Best of Micro, Vol 2 £9.10
Programming the 6502 (Zacs) £9.10
6502 Applications £7.25
6502 Software Gourmet Guide and Cookbook £10.00
The PET Revealed £10.00
Library of PET Subroutines £10.00
32 BASIC Programs for the PET £10.10
First Book of KIM £7.00
PET/CBM Personal Computer Guide (2nd edition) £10.00

FOR THE 8080

See Osborne Books! £1.95
8080 Hex Code Card £1.95
8080 Octal Code Card £7.15
8080 Software Gourmet Guide and Cookbook £6.75
8080/8085 Software Design £8.95
8080 Standard Monitor £8.95
8080 Standard Assembler £20.00
8080 Standard Editor £8.95
8080 Special Package: Monitor, Editor, Assembler £20.00
BASIC: A simple Language and Compiler for the 8080 £5.50

FOR FUN

BASIC Computer Games £5.00
More BASIC Computer Games £5.50
8080 Galaxy Game £6.95
SUPER-WUMPUS—A Game in 6800 Assembler Code & BASIC £4.25
Computer Music Book £6.75
Computer Rage (a Board Game) £6.95
Introduction to TRS-80 Graphics £5.75
Take My Computer Please... (Fiction) £3.25
Introduction to Low Resolution Graphics for PET, Apple TRS-80 £5.50
Starship Simulation £4.50
Microsoft BASIC: University Software Inc., Listings: £9.50
Fun and Games Programs 1 £9.50
Fun and Games Programs 2 £9.10
6502 Games

FOR THE NOVICE

See Magazines and Subscriptions! £5.50
Getting Down to Business with Your Microcomputer £5.50
Getting Involved with Your Own Computer £5.50
How to Profit from Your Personal Computer £1.95
Microcomputer Potpourri £3.00
Hobby Computers are Here £3.00
New Hobby Computers £3.00
Understanding Microcomputers and Small Computer Systems £6.95
Understanding Microcomputers and Small Computer Systems and Audio Cassette £8.75
How to Make Money with Your Microcomputer £5.75
From the Counter to the Bottom Line £10.00
Buying a Business Computer £9.75
You Just Bought a Personal What? £7.95

MAGAZINES

MAGAZINE SUBSCRIPTIONS (all processed within 3 weeks)

Micro 6502 Journal (12 issues) £14.50
68 Micro (12 issues) £18.00
Personal Computing (12 issues) £18.00
Interface Age (12 issues) £25.50
Dr Dobbs Journal (12 issues) £16.00
Recreational Computing (6 issues) £11.50
BYTE (12 issues) £33.00
Creative Computing (12 issues) £22.00
Kilobaud Microcomputing (12 issues) £26.00
Compute for the 6502 (12 issues) £22.00
80' Microcomputing (12 issues) £25.00
S-100 Microsystems (for CPM users) (6 issues) £10.50

MAGAZINE BACK ISSUES

Micro 6502 Journal £1.75
Personal Computing £1.95
Interface Age £2.95
Dr Dobbs Journal £1.95
Computer Music Journal £3.75
Recreational Computing £1.95
BYTE £3.25
Creative Computing £1.95
Calculators and Computers £1.95
Kilobaud Microcomputing £3.25
Compute—for the 6502 £2.25
68' Micro £1.95
80-Microcomputing £2.95
On Computing £1.95
S-100 Microsystems £1.95
Magazine Storage Box (holds 12) £2.00

BYTE NIBBLE REPRINTS:

a) A TMS-9900 Monitor £3.50
b) BASIC Cross-Reference Generator £1.25
c) A Micro Word Processor £4.50
d) 'Tiny' PASCAL in 8080 Assembly Language ('e needed to use this) £13.00
e) A 'Tiny' PASCAL Compiler £13.50
f) An APL Interpreter in PASCAL £13.00
g) Computer Assisted Flight Planning £2.35
h) Computerized Wine Cellar £2.00
i) The Design of an M6800 Lisp Interpreter £13.00

8-11 CAMBRIDGE HOUSE, CAMBRIDGE ROAD, BARKING, ESSEX IG11 8NT, ENGLAND.
Telephone 01-591 6511 Telex: 892395

SOFTWARE

		Software & Manual Only
Byrom Software	BSTAM—Utility to link one microcomputer to another also using BSTAM BSTMS—Utility to link a micro to a mini or mainframe	£95/5 £95/10
Compiler Systems	CBASIC v2.07	£65/15
Computer Plus	FMS 80 (File Management System)	£395/25
CP/M User Library	42 Volumes—Price per volume 8" disc (one volume per disc) 5" disc (one volume per 2 discs) Index	£4 £8 £1
Creative Computing	CS-9001 BASIC Games 1 CS-9002 BASIC Games 2 CS-9000 BASIC Games 1 and 2 CS-9003 ADVENTURE I.O. CS-9004 BILINGUAL Original Adventure CS-9005 BASIC Games 3 CS-9006 BASIC Games 4 CS-9007 BASIC Games 3 and 4 CS-9008 BASIC Games 1, 2, 3 and 4	£12 £12 £22 £12 £12 £12 £22 £40
Digital Research	(Most formats now available) MPM 1.1 CP/M86 CP/M 2.2 CP/NET SID ZSID MAC TEX DESPOOL PL/1	£175/18 £145/25 £90/18 £110/12 £45/12 £55/12 £55/12 £45/12 £30/5 £325/25
Information Unlimited	WHATSIT (Database Management System) on North Star on CP/M on APPLE 2:48k (requires int Basic) on APPLE 2:32k (requires int Basic) on ITT 2020 (see Apple)	£59 £75 £72 £59
KLH Systems	Spooler for CPM systems v3.0	£65/5
MPI Ltd.	Multiforth OMNIX—UNIX like multiuser, multitasking operating system for Z80 i.e. IMS, Cromemco PAYROLL	£65/20 £495/30 £500/15
Micah Inc.	CP/M for CDOS Users: Program to Expand CP/M system to be compatible with Cromemco CDOS software	£59/5
Michael Shroyer Inc.	Electric Pencil Word Processor SSII for tty etc DSII for Diablo TRS-80 Cassette/disc	£100 £100 £105 £50
Microfocus Ltd.	CIS COBOL version 4.3 FORMS 2	£425/25 £100/10
Micropro Inc.	WORD-MASTER 1.7A TEX-WRITER 2.6 WORD-STAR 2.25 MAIL-MERGE 2.25 WORD-STAR with MAIL-MERGE SUPER-SORT: Version 1 Version 2 DATASTAR 1.1	£70/20 £35/15 £240/35 £70/10 £310/45 £120/20 £100/20 £165/20
Microsoft Inc.	BASIC-80 BASIC Compiler 5.24 FORTRAN-80 3.42 COBOL-80 4.3 M/SORT 1.0 EDIT-80 2.0 MACRO-80 3.42 MICROSEED MULTISP MUMATH 2.02 XMACRO-86 XFORTRAN-86	£175/17 £195/17 £220/17 £355/17 £70/11 £45/11 £80/11 £TBA/20 £TBA/20 £140/20 £185/11 £410/17
Microtech Exports	Reformatter CPM ↔ IBM CPM ↔ DEC	£95/15 £95/15
MT Microsystems	Pascal MT 5.2 Library Sources Softbus	£150/20 £100/ £105/
Northshare	Multi-user system for Horizon Users 5.2	£40/5
Osborne & Associates	Accounts Payable & Accounts Receivable General Ledger Payroll with Cost Accounting	£50/14 £50/13 £50/14
Phoenix Software Associates (For Z80 only)	PLINK—Disc to disc link loader PASM—Macro assembler PEDIT—Line editor with Macros BUG—Very powerful debug Package with all the above	£65/15 £65/15 £65/15 £65/15 £175/30
Structured Systems (All Converted to UK Standard)	Sales Ledger Purchase Ledger Nominal Ledger Stock Control Letterright Analyst (File management Reporting System) NAD (Name and Address selection system) OSORT	£350/15 £350/15 £350/15 £350/15 £95/10 £115/10 £50/10 £50/10
Supersoft Inc.	DIAGNOSTICS 1 DIAGNOSTICS 2 TERM	£40/7 £50/7 £65/5
TDL Software (Technical Design Labs)	Business Basic ZTEL (Text Editing Lang.) MACRO II (Z80 Macro Assembler) LINKER DEBUG II (for 8080/Z80)	£80 £35 £35 £35 £45
Tiny-C Associates	Tiny-C language for 8080, 8085, Z80 systems	£50/35

ORDER INFORMATION

Software prices reflect distribution on 8" single density discs. If a format is requested which requires additional discs a surcharge of £4 per additional disc will be added.

Please add £3.00 for postage, packing and insurance plus VAT on ALL software items (including manuals) purchased. For overseas please add £4.50 per item.

If required, 'OVERNITE' service is available for an extra charge of £8.50.

Most software on this Advertisement is available from stock and a 72-hour return service is thereby offered on most prepaid orders. When ordering CP/M software please specify the format you require otherwise software will be dispatched on an 8" single density disc.

For more information on any of these items, please phone, write or visit. (We are open during office hours).

All publications are published in the U.S.A. and are stocked in Britain by L.P. Enterprises: M.P.I. Ltd.

We aim to keep all of these books in stock and as a result of this most mail orders are despatched by return of post.

MAIL ORDER TELEPHONE ORDER VISIT

Send Cash, Cheque, Postal Order, IMO, ACCESS or Barclaycard number to Microcomputer Products International Ltd, Room P.C.W, 8 Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.

All Payment must be in sterling and drawn against a UK bank.

Subscriptions are processed to start with the next current issue, after the date of order.

Please add £0.75 for postage on EACH book ordered.

These details are all current as of April 1981.

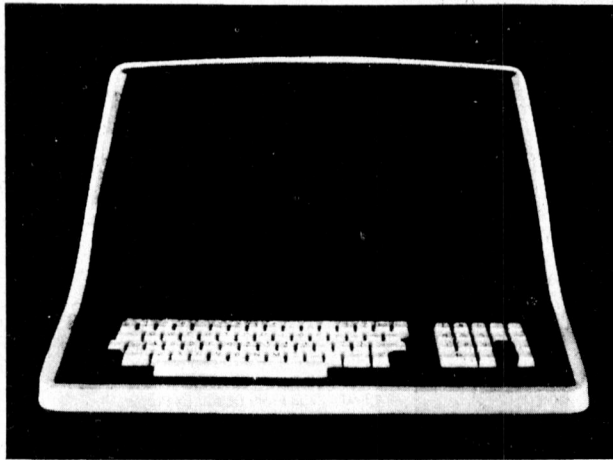
Prices are subject to change without notice, due to fluctuation in the dollar rate.

Catalogue £1.00, deducted from your first purchase.

OEM
terms
available

GW Computers Ltd

CALLERS BY APPOINTMENT ONLY
LONDON WC1. TEL NO. 636 8210/631 4818



SUPERBRAIN™

Intelligent Video Terminal Systems
350K or 700K of Disk Storage

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL and APL. Whatever your application. . . General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is top in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K of RAM. All standard!

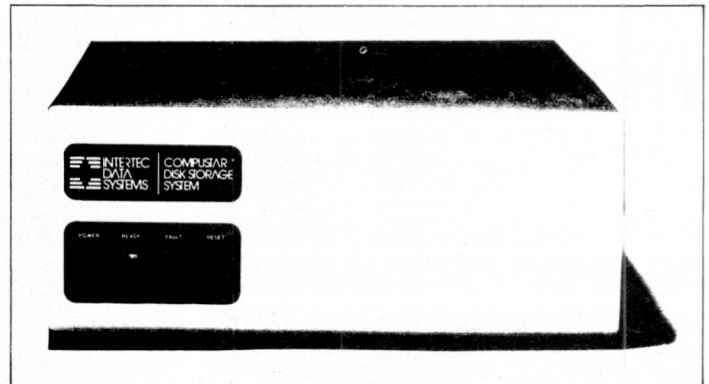
COMPUSTAR™

Functional characteristics

The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller — all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controller will permit up to 255 users to "share" the resources of the disk with minimal CPU response degradation.

Read/Write Heads and Disks

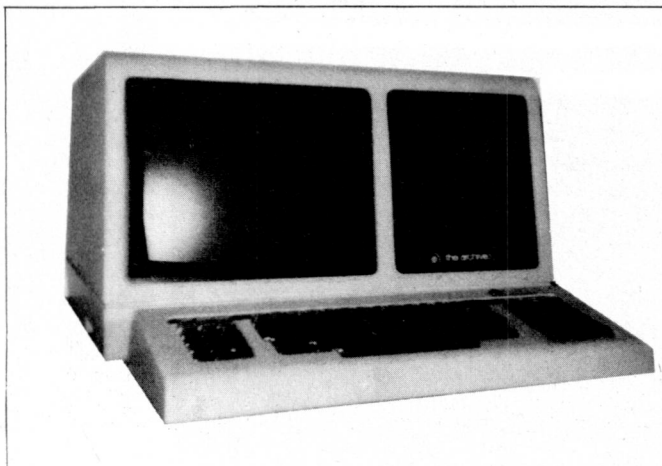
The recording media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminium substrate. This coating formulation, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 256 tracks.



SYSTEMS.1

Hardware

Processor	:	Z-80A at full 4 MHZ
Memory	:	64 K RAM Standard
Disk Storage	:	One 77-track drive, 5¼" disks, soft-sectored. 750 K bytes per drive. One 5 Megabyte ST506 hard disk
Display	:	12" Green phosphor Monitor 25 lines x 80 characters 240 x 100 Graphics format Screen attributes including inverse, video, blink and underline in any of 8 intensities
Keyboard	:	Microprocessor keyboard Selectric style Lefthand function keycluster Righthand numeric keycluster 23 relegendable function keys
I/O	:	Both serial and parallel



CORRESPONDENCE ADDRESS ONLY: 55 BEDFORD
COURT MANSIONS, BEDFORD AVENUE, LONDON WC1.

*** MAIN MENU DISPLAY ***

WIDELY USED IN UK/France/USA AND ENGLISH SPEAKING COUNTRIES FOR ITS OVERALL FLEXIBILITY AS A COMPLETE BUSINESS PACKAGE.

Includes Inventory, Database, Management, Invoicing, Mailing Addresses, Statements, Sales/Purchase Ledger with or without Auto Stock Update and Double Entry Journals including Nominal Ledger; plus A/C Receivable and Payable making Auto Bank entries.

- | | |
|-------------------------------|-------------------------------|
| 01= ENTER NAMES AND ADDRESSES | 13= PRINT CUSTOMER STATEMENTS |
| 02= SALES INVOICES | 14= PRINT SUPPLIER STATEMENTS |
| 03= A/C RECEIVABLES | 15= PRINT AGENT STATEMENTS |
| 04= PURCHASE INVOICES | 16= PRINT TAX STATEMENTS |
| 05= A/C PAYABLES | 17= RUN SEPARATE PROGRAMS |
| 06= STOCK CONTROL | 18= CHANGE VOCABULARY |
| 07= ORDER CONTROL | 19= PRINT YEAR AUDIT |
| 08= BANK UPDATES | 20= PRINT PROFIT/LOSS ACCOUNT |
| 09= SALES LEDGERS | 21= DISK DIRECTORIES |
| 10= PURCHASE LEDGERS | 22= CASHFLOW FORECAST |
| 11= INCOMPLETE RECORDS | 23= PAYROLL (N/AVAILABLE) |
| 12= USER DATABASE AREA | 24= DISK SWAP/EXIT SYSTEM |

WHICH OPTION

Database options are:

Within the limits of twelve fields and 256 characters per record, any file architecture can be designed with complete freedom over the linguistic conventions assigned to each field. The file can then store 32000 records which can be searched by the random access number (retrieved in less than one second) or sequentially comparing for left field parts, field-inkeys, or parts of record, and then changed, printed, deleted, skipped.

GRAMA (WINTER) LTD/G.W. COMPUTERS LTD are the producers of this package which is unequalled for its level of total integration, linguistic flexibility and maximised disk/memory conservation.

Author Tony Winter (M.D.; B.A. LIT; B.A. HON. PHIL; AND LECTURER)

Price of the package is 975.00 (excluding menu items 19, 20, 22, 23) or 1075.00 for the full package (23 available end year, 19, 20, 22 being currently included). Requires MBASIC-80 and runs only on hardware on our price list.

DUE TO LONG TERM CONTRACTUAL COMMITMENTS, WE ARE ONLY GIVING RESTRICTED DEMONSTRATIONS BY APPOINTMENT AT ONE OF OUR LONDON OFFICES. WE EXPORT TO ALL COUNTRIES, TAKE AMEXCO, ACCESS AND BARCLAYCARD.
CONTACT TONY WINTER ON 01.636.8210 OR 01.631.4818 AND IF UNAVAILABLE THEN LEAVE A CALL-BACK MESSAGE (CLEARLY STATING YOUR TELEPHONE NUMBER AND NAME) ON THE 24-HOUR ANSWER-PHONE, WE CALL BACK ANYWHERE IN THE WORLD.

IMPORTANT!!! No hardware is any value without the software, and our software is unequalled. We give you a discount to set you going. Just decide on the system you intend purchasing, and take 10% of its value off the price you would have to pay for the software. You could get the software free with the hardware if you choose the best system we sell.

SUPERBRAIN * SUPERBRAIN	/	COMPUSTAR * COMPUSTAR	/	PRINTER * PRINTER
64K + 320 K DISK 1850.00	/	64K MDL 10 VPU 1595.00	/	OKI MICRO-80 395.00
64K + 700 K DISK 2195.00	/	64K MDL 15 PRNT 1495.00	/	CENTRONIC 737 425.00
64K + 1.5 M DISK 2795.00	/	64K MDL 20 VPU 2295.00	/	EPSON MX80 395.00
EMULATOR TRML 495.00	/	64K MDL 30 VPU 2495.00	/	TEXAS 810 1395.00
INTERTUBE III TML 495.00	/	64K MDL 40 VPU 2795.00	/	DIABLO 630 1595.00
16 MEG CDC H. DISK 3950.00	/	10 MEG INTERTEC 2950.00	/	NEC 5530 1595.00
40 MEG CDC H. DISK 4750.00	/	32 MEG INTERTEC 7950.00	/	NEC 5510 1695.00
CORDLESS PHONES 135.00	/	96 MEG INTERTEC 8500.00	/	NEC 5525 1895.00
SHUGART DRIVES 95.00	/	BUS PROGRAM 975.00	/	QUME 5/55 1950.00
TRACTORS 150.00	/	BUS MANUAL 9.00	/	SHEET FEED 850.00
SHUGART 5 MEG DSK 1500.00	/	S100 CONTROLLER 750.00	/	CP/M (TM) FREE
SYSTEM 1 3750.00	/	SYSTEM 2 5550.00	/	SYSTEM 3 7250.00
64K + 750 K DISK	/	64K + 5.3 M DISK	/	64K + 10.6 MEG
CRT & S100 BUS	/	CRT & S100 BUS	/	CRT & S100 BUS
IN 1 INTEGRAL UNIT	/	IN 1 INTEGRAL UNIT	/	IN 1 INTEGRAL UNIT
MBASIC 80 150.00	/	FORTAN-80 200.00	/	COBOL-80 320.00
CIS COBOL 420.00	/	PASCAL UCSD 275.00	/	WORD-STAR 195.00
MAIL MERGE 55.00	/	SUPER SORT 120.00	/	CBASIC 75.00
DASTAR 190.00	/	BASCOMPILER 190.00	/	TEXTWRITER 75.00

OUR PRICE INCLUDES FREE:

TRAINING SESSION

CABLES

EXTENDED WARRANTY IF REQD

CPM HANDBOOK

IF YOU WISH TO MAKE THE WARRANTY TO 1 YEAR THEN ADD 5% OF HARDWARE COST. OTHERWISE NO MAINTENANCE SCHEDULE, SIMPLY AD-HOC CHARGES AFTER WARRANTY EXPIRATION, SAME QUALITY SERVICE.

10% OF HARDWARE PRICE OFF ANY SOFTWARE.

DELIVERY

6/12 MTH WARRANTY

RIBBONS & THIMBLES

BASIC MANUAL

5/10/15/20 DISKS

24/48 HOUR REPAIR

MANUALS

2000 SHEETS PAPER

DUE TO LONG TERM CONTRACTUAL COMMITMENTS WE ARE ONLY ABLE TO GIVE RESTRICTED APPOINTMENTS AT ONE OF OUR LONDON OFFICES. CONTACT TONY WINTER ON TELS 01.636.8210 AND 01.631.4818. ALSO 24 HOUR ANSWERPHONE. IF YOU JUST WANT LITERATURE THEN CLEARLY STATE YOUR NAME AND ADDRESS, WE WILL MAIL YOU A STANDARD INFORMATION PACK.

CHROMASONIC

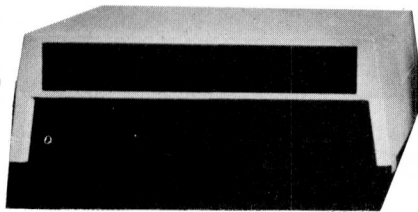
electronics

Dept PCW, 48 Junction Road, Archway, London N19 5RD, UK. Telephone: 01-263 9493 / 01-263 9495

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPONENTS AND COMPUTERS

IDEAL FOR YOUR BUSINESS

4008 8k RAM
4016 16K RAM
4032 32K RAM
C2N Cassette Unit
4040 Dual Drive Disk



PETS AND SYSTEMS



IDEAL FOR WORD PROCESSING

8032 New 32k with 80 col screen
8050 Twin Disk Drive 950K
8026 Letter quality daisy wheel printer/typewriter
3023 Friction feed printer
4022 Tractor feed printer



COMPLETE 32K SYSTEMS AVAILABLE

PHONE FOR MOST COMPETITIVE PRICES

APPLE SYSTEMS

APPLE II EUROPLUS

16K MACHINES £549
32K MACHINES £579
48K MACHINES £595

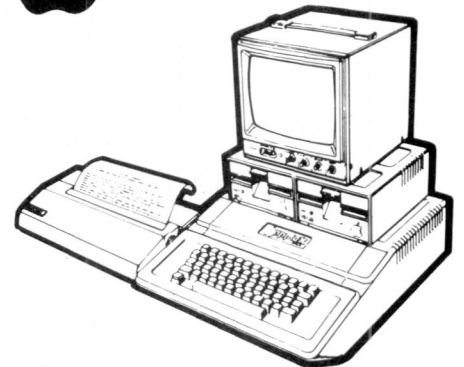
DISK DRIVE WITH
CONTROLLER £375
DISK DRIVE WITHOUT
CONTROLLER £299

ACCESSORY CARDS
SOFTWARE
ALL AVAILABLE

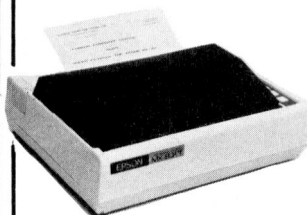
PHONE FOR FURTHER DETAILS

APPLE II PLUS features:

- * High Resolution Graphics
- * Sound capabilities
- * Internal memory expansion capacity of 48K
- * 8 accessory expansion sockets
- * APPLE II extended Basic
- * 9 digit arithmetic precision
- * Auto-Start automatically runs programs with computer turn-on
- * Hand controlled for games etc.
- * 15 colour standard graphics.



PRINTERS



EPSON MX80 £359

Dot-matrix printer with PET graphics interface. Centronics parallel and serial: Pet and Apple compatible. True bidirectional, 80 cps

EPSON-MX80 FT/1 £399

Dual single sheet friction and tractor, 9 wire head, true decimeters

EPSON-MX80 FT/2 £499

An FT/1 with high resolution graphics

EPSON MX70 £259

Tractor feed, 7 wire head high resolution graphics.

SEIKOSHA GP80A £199

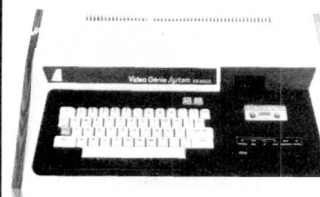
Dot matrix 5x7, 80 columns 30 cps, graphics, double width characters.



GP80A

Interfaces for Apple, PET,
TRS-80 & RS 232 available.
JUST PHONE FOR FURTHER DETAILS

VIDEO GENIE —EG3003—



VIDEO GENIE based on TRS80

Utilises Z80, 12k level II Basic, Integral Cassette Deck, UHF, O/P, 16k RAM, all TRS80 features. Simply plug into monitor or UHF with VU meter

£279

Expansion box	£185.00
Expansion box (with RS232)	£215.00
16k RAM card	£94.00
32k RAM card	£129.00
Single disk drive (35 track)	£215.00
Dual disk drive (40 track)	£410.00
Parallel printer cable	£17.00
Disk drive cable (4 drives)	£32.00
Dual disk drive cable	£17.00
Parallel printer cable for unexpanded-Video Genie	£33.00
Sound Kit (fitting extra)	£7.00
Lower case Kit (fitting extra)	£27.50
Video Genie technical manual	£5.00

NEW	Chromasonic Sound Kit (using AY-3-8910)	£24.95
	Colour Kit	£34.95

UK 101

£149 IN KIT FORM
£199 READY BUILT & TESTED
£225 COMPLETE IN CASE
4K Expansion (8x2114)
NOW ONLY £14.00

No extras required

* Free sampler tape

* Full Qwerty keyboard

* 8K basic

* Ram expandable to 8K on board (4K inc)

* Kansas City tape interface

* NEW MONITOR ALLOWS FULL EDITING & CURSOR CONTROL NOW INCLUDED IN KIT



CASES

AVAILABLE FOR UK 101, SUPERBOARD, NASCOM.

Approx. dimensions 17" x 15"

PRICE £24.50 Post & packing £1.50

UK 101 MEMORY BOARD

* On board power supply (uses the UK101 transformer)
 * Facility for 4k eeprom expansion * Fully buffered for expansion via 40pin socket * 40 pin header & 8T28's included.

8K kit (inc 16K skts) **£79.95** 16k kit **£106.95**

Printed circuit board **£29.95**

PARALLEL PERIPHERAL INTERFACE

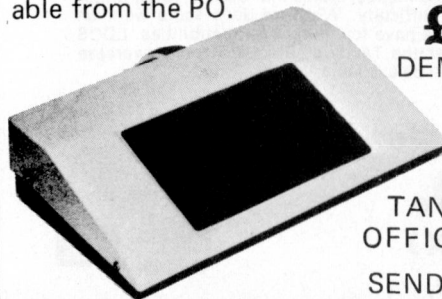
UK101 and Superboard compatible. Interfaces to GP80, MX80 series, TX80, Centronics PI, etc printers. Can operate relays, motors, various other peripherals. LED Binary displays. Plugs into ACIA socket. Fully documented. Built and tested.

ONLY £29.95

TANTEL

PRESTEL BY TANTEL

The greatest thing since television & telephones. Communications at your fingertips for business & home. 180,000 pages of up-to-date information on travel, news, investment, holidays, hotels etc etc. Ask Prestel a question and you have your answer in seconds in full colour on your own TV. Only requires a telephone jack socket available from the PO.



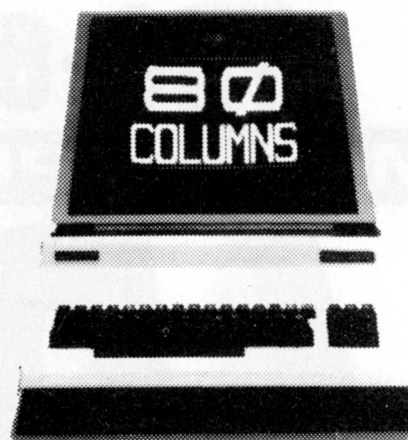
£170

DEMONSTRATION AVAILABLE AT OUR SHOWROOM

TANTEL IS POST OFFICE APPROVED

SEND FOR DETAILS

WORD PROCESSING



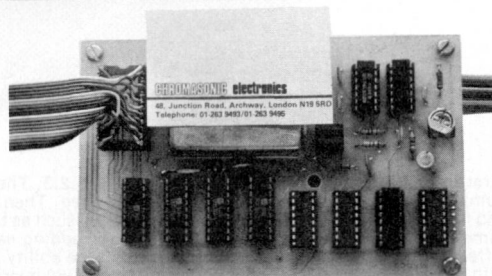
Use your 80 column PET to its full business potential by installing "WORD PRO 4" the low cost Commodore approved word processing system write or call Julia on 01-263 9495 to arrange a demonstration

UK 101 COLOUR BOARD



a UK PRODUCT

AT LAST!!!



Designed to simply plug into your computer and any standard colour television in "8" glorious colours

INCLUDES FULL DOCUMENTATION AND DEMONSTRATION TAPE

UK101, SUPERBOARD **£84.95**

AVAILABLE FOR PET **£98.95**

SEND FOR FURTHER DETAILS

MONITORS

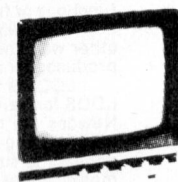
EG 100 12" black & white **£65**

Moni 9" (illust) black & white **£82**

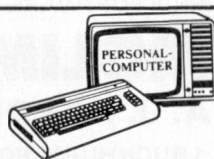
HITACHI PROFESSIONAL MONITORS

9" Black & white **£99.95**

12" Black & white **£149**



VIC20



NEW FROM COMMODORE ! COMING SOON ! PHONE FOR DETAILS !



Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard (Min tel order £5). Trade and export enquiries welcome. Credit facilities arranged.



INNOVATIVE

TRS-80 SOFTWARE

FROM THE PROFESSIONALS

LDOS

First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos+, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos+, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATTRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5 1/4" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not surprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

LDOS£85.00 plus VAT and £1.50 P&P.

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.



MOLIMERX LTD.

A. J. HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE,
BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G



INNOVATIVE TRS-80 SOFTWARE FROM THE PROFESSIONALS COMPAK

The title of this program is a composite word which may be interpreted in two ways, either as standing for Complete PaCK of programmer's aids or as standing for one of the principal features of the program, namely the ability to compress Basic programs to a bare minimum. The suite is made up of four broad categories of utilities. In the aggregate they comprise a complete utility containing every foreseeable feature that a Basic programmer could require. It is written by Nigel Dibben in his usual efficient way and some indication of the complexity and completeness of the program is shown by the fact that even Dibben has been working on it for some number of months!

Up until now, very useful utilities have been sold by us separately, and, of course, we will continue to do so, but for some time it has become obvious that there is a market for a utility program that does everything. Whilst the author was working on this concept, we asked him to include a program which would compress Basic programs over and above the usual simple removal of spaces and REM statements. Actually the original idea for the compression of programs came from software which has been written for the Model II and which is featured in our catalogue under the name SKRUNCH and COMPRESS. The resulting program is, as we have said, a complete programmer's aid for the serious Basic programmer.

The complete program occupies 7 or 8K of RAM. Although this is no problem to the disk user, it may well be to the 16K tape user. In order to get over this difficulty (and incidentally to save money for users who have some of the utilities already) the program is available in two parts in addition to being available in the whole. The two parts are deliberately sold at the same price and at a price such that the sum of them is equal to the composite. Thus the customer does not lose from buying his program in two sections. The program is split so that COMPAK1 contains the compression and general purpose sections. COMPAK2 contains the debug, edit and general purpose sections. COMPAK contains all of the foregoing. All are compatible with both Level II Basic and Disk Basic and can be supplied either on tape or disk. The disk version contains all three programs.

Space does not allow us to describe COMPAK at any length. It is, of course, fully described in our catalogue, but briefly, split into its various sections, the features are as follows:—

COMPRESSION: Removes all redundant characters or blanks including non-used GOTO statements after THEN, redundant colons, redundant quotation marks, etc. After all redundant characters have been removed the program may be packed so that all lines that can be syntactically joined together will be. Further packing may also be carried out, the effect of which is to make the program almost unreadable but still workable.

DEBUG: Over 12 DEBUGging features are included which enable the program to be traced through step by step or line by line. Breakpoints may be inserted and the contents of variables may be displayed all the time. When an error is found the Edit mode may be entered immediately and automatically. Essentially, the DEBUG feature permits the programmer to find even the most hidden of bugs.

EDITING: Includes a complete user definable shorthand for shifted keys. Occurrences of strings and variables may be found and counted. They may also be found and a wait executed so that the user may enter Edit or whatever. The find feature may be extended so that it will automatically find the occurrence and replace it with another user defined statement or string. Lines may be joined together with the automatic insertion of a colon. Lines may be checked for incorrect referencing and marked accordingly. Lines may be copied one to the other. Programs may be appended one to the other; in other words, a block is inserted after the current program so that another may be fed in and then the both joined together. An unusual feature is the ability to decode PACKED strings which contain machine language or graphics code.

GENERAL PURPOSE: A complete renumbering function together with the ability to change the renumbering increment in mid-program. A status report displays the space used by all relevant parts of the program such as arrays and variables plus of course the program itself. A Rescue feature is included so that "lost" Basic programs may be recovered. A lower case switch may be initiated so that lower case characters are printed out rather than the shorthand previously described.

We would emphasise that the above is only a synopsis of the features of this extensive program. We are not aware of any incompatibilities with the current Video Genies.

Level II tape: Compak1 or Compak2 £15.00

Level II tape: Compak £30.00

Disk version: All three programs £33.00

All prices are exclusive of VAT. Add 75p for P & P.

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.



MOLIMERX LTD.

A. J. HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE,
BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G



FERGUSSON COMPUTER SERVICES

**WE ARE PLEASED TO ANNOUNCE
THE OPENING OF OUR NEW
DEMONSTRATION CENTRE
in SURREY**



SALES AND SERVICE

Contract Maintenance:-

- * On-site repair contracts
- * Total system or only items required
- * 24hrs response to calls
- * Very competitive rates

Ad-hoc Repair Service:-

- * Ring for repair quotation
- * Same day service
- * Collection from Red Star if required

Hardware and Software Sales:-

- * 32K RAM free with each system purchased with this advertisement
- * Integrated ledger system (open item) £2575 for everything!!

For further information ring
Byfleet (09323) 45330/41810

**COME AND SEE US SOON AT
Fergusson Computer Services
4 Pyrford Road, West Byfleet, Surrey**

Making a meal of office paper work?

**Here's
a menu
more
to
your
taste**

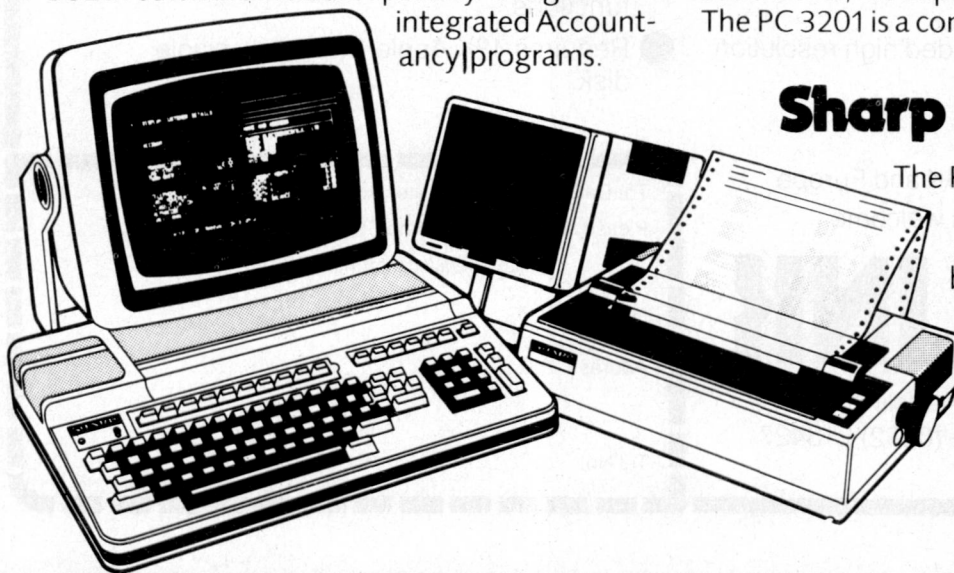


More efficient

A 'menu' is a guide to the series of programs available. On the PC 3201 business computer, that menu will allow rapid access to Large Storage Capacity – providing detailed information vital to the efficient running of any company... without having to wade through old-fashioned ledgers. PC 3201 software includes specially-designed integrated Accountancy programs.

Easy-to-use

The typewriter-style keyboard incorporates a numeric pad for fast, simple entry data. Visually, an 80 column screen provides crisp, clear information every time. And to keep everything safely in black and white there's a fast quiet printer to provide clearly-typed sheets of invoices, statements, file copies ... anything you require. The PC 3201 is a complete business system.



Sharp reliability

The PC 3201 is designed and built in Japan, by Sharp – and its sound reliable service is backed by Sharp's nationwide dealer network.

SHARP
First, and foremost

Computer Division, Sharp Electronics (UK) Ltd.,
Sharp House, Thorp Road, Newton Heath,
Manchester M10 9BE.

DATALINK

Calling all serious
 **apple® users!**

Announcing Applied Analytics

MICRO SPEED

The microspeed language system

- Runs six to sixty times faster than Basic.
- Programming capabilities well beyond Applesoft.
- Auxiliary Processor (Am 9511) for fast floating point.
- High-speed, extended high resolution graphics.
- Software development time cut in half.
- Exceptionally compact, compiled code.
- Extensible, structured language to meet your needs.
- Bonus: increased speed Applesoft functions.
- Requires 48K Apple 11 or 11+, single disk.

Sole distributors for UK and Europe
Retailer enquiries welcome

DATALINK

10, Waring House Redcliffe Hill
BRISTOL BS1 6TB Tel: (0272) 213427

To: Datalink Microcomputer Systems Limited.

Please send ☐ Complete System £290 + VAT
☐ Detailed information

Name

Address

Tel No:

SEIKOSHA



The Seikosha GP80A
Manufactured by the Seiko Company, Japan.

The micropriced microprinter

80 col dot graphics for £225

EX. VAT.
REC.
PRICE.

Seiko's new Seikosha GP80A offers big printer performance at a fraction of the cost. High quality output, proven reliability and a variety of interfaces make the GP80A an ideal choice for hobbyists, educationalists and businessmen. Service is provided by DRG's nationwide distributor network.

Available with full dealer support from:

LONDON

Electronic Brokers. (01) 278 3461.
Chromasonic. (01) 263 9493.

WATFORD

Watford Electronics. (0923) 40588.

BRISTOL

Datalink Microcomputer Systems Limited.
(0272) 213427.

CARDIFF

Sigma Systems. (0222) 21515.

BIRMINGHAM

Westwood Computers Ltd. (021) 632 5824.

LIVERPOOL

Microdigital. (051) 227 2535.

BOLTON

Professional Data Systems. (0204) 493816.

SHEFFIELD

Microdigital. (0742) 750971.

ASCOT

Riva Terminals Limited. (03447) 5193.

BELFAST

Mackenzie Computer Services.
(0232) 760325.

FEATURES INCLUDE

- 80 col. 30 cps.
- Dot Matrix unihammer action
- 96 ASCII + 32 European characters
- Full graphics
- Upper and lower case
- Double width printing
- Up to 8" paper width
- Up to 3 copies
- Pin feed
- Self testing

INTERFACING for most systems

- Standard: Centronics
- Options: RS232C, PET 2001
TRS-80, Apple II, IEEE-488

OPTIONAL EXTRA

- Plain paper feed

DRG

BUSINESS MACHINES

For full product information and details of new dealers that may not appear above, ring the UK Master Distributor, DRG Business Machines on 0934 416392.

(Peripherals & Supplies Division) Unit 8, Lynx Crescent, Winterstoke Rd,
Weston-super-Mare, BS24 9DW.

THE FINEST WORLDWIDE SUPPORTED NATIONWIDE.

A MAJOR COMPUTER BREAKTHROUGH... ...WITH A MINOR COMPUTER PRICE-TAG



Things develop fast in computers – but so do prices! So who could have dreamt of a high-performance multi-user multiprocessor system for under £10,000?

Yet the Jarogate Z2-HMP is just that.

It has the multi-user cost-sharing advantage, yet ingeniously solves the big problem that has bugged multi-users until now . . . the serious degradation of performance caused by a shared CPU.

With the Jarogate Z2-HMP, each user has his own full CPU with 64k/bytes of RAM (CP/NET plus 60k of available user memory). And there's a high-speed parallel bus giving fast interprocessor communication so that users can have access to the central disk resources without the usual communication bottlenecks.

Those disk resources (the well-proven Cromemco Z-2H) are 10M/bytes of hard disk and 720k/bytes of floppy.

If you think all this is remarkable for under £10,000, look at some other specifications:

- Uses industry-standard MP/M and CP/NET
- Four users as standard – expandable to seven
- Features standard Cromemco hardware, including the well-proven Z-2H
- One 21-slot motherboard and power supply
- Existing CP/M programmes can be transferred direct
- Printer interface
- Complete system in attractive mobile furniture

Price: Complete Jarogate Z2-HMP, £9,995 (plus VAT)

For existing Cromemco Z-2H users, an upgrade package of hardware and software is available for £4,995 (plus VAT).

Illustrated data sheet available – just phone or write for a copy.

JAROGATE

JAROGATE LIMITED

MICROPROCESSOR CONSULTANTS

67 Tulsemere Road, West Norwood, London SE27 9EH
Telephone: 01-670 3674

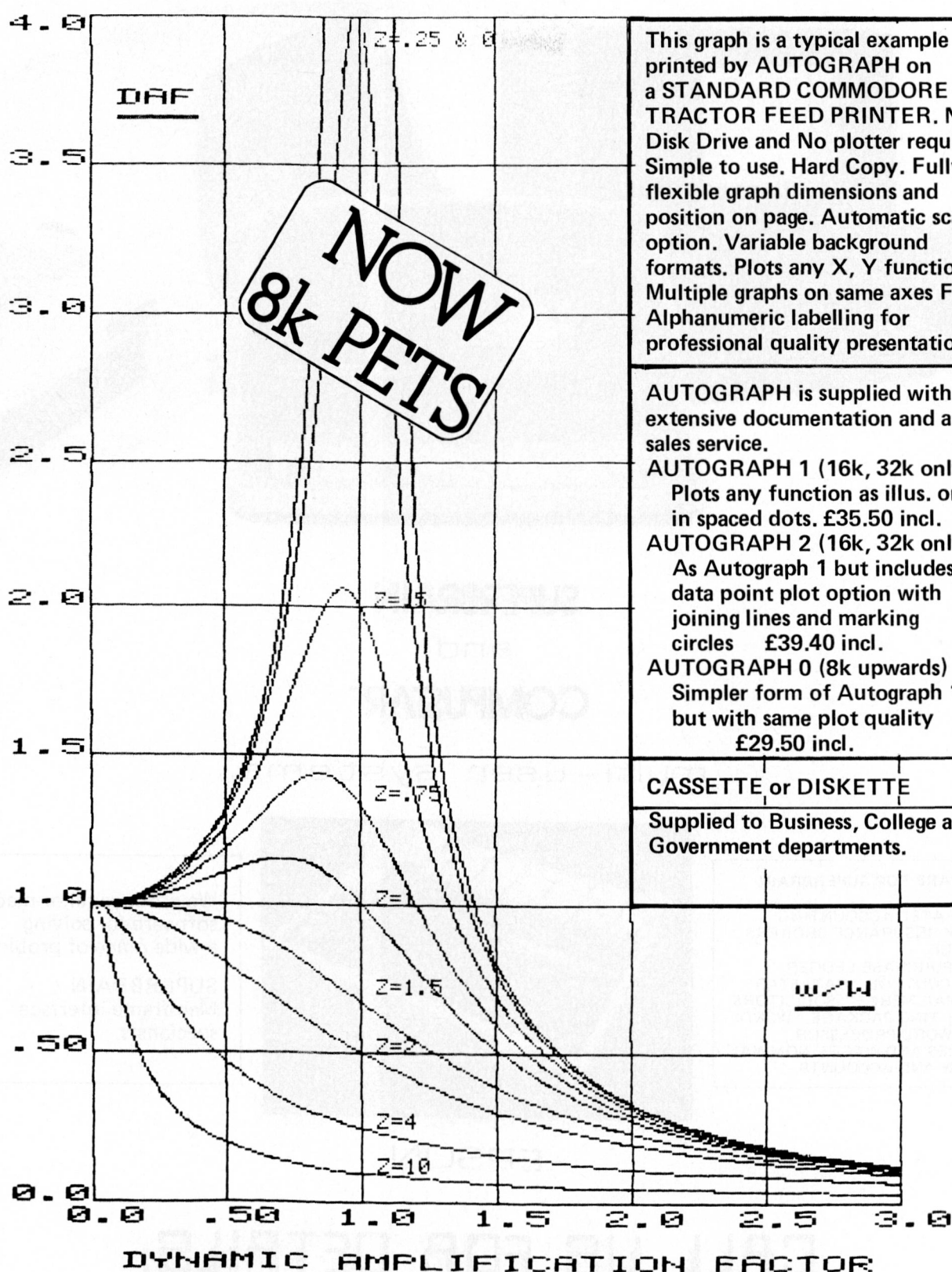


PET PRINTER GRAPHICS



by
COMPUTACE LTD

INFABCO HOUSE, 552 LONDON RD.
NOTH CHEAM, SUTTON, SURREY.



This graph is a typical example printed by AUTOGRAPH on a STANDARD COMMODORE TRACTOR FEED PRINTER. No Disk Drive and No plotter required. Simple to use. Hard Copy. Fully flexible graph dimensions and position on page. Automatic scale option. Variable background formats. Plots any X, Y function Multiple graphs on same axes Full Alphanumeric labelling for professional quality presentation:

AUTOGRAPH is supplied with extensive documentation and after sales service.

AUTOGRAPH 1 (16k, 32k only)

Plots any function as illus. or in spaced dots. £35.50 incl.

AUTOGRAPH 2 (16k, 32k only)

As Autograph 1 but includes data point plot option with joining lines and marking circles £39.40 incl.

AUTOGRAPH 0 (8k upwards)

Simpler form of Autograph 1 but with same plot quality £29.50 incl.

CASSETTE or DISKETTE

Supplied to Business, College and Government departments.

EXAMPLE No 6.3



in the west-midlands

WE STOCK AND DISTRIBUTE:



SUPERBRAIN

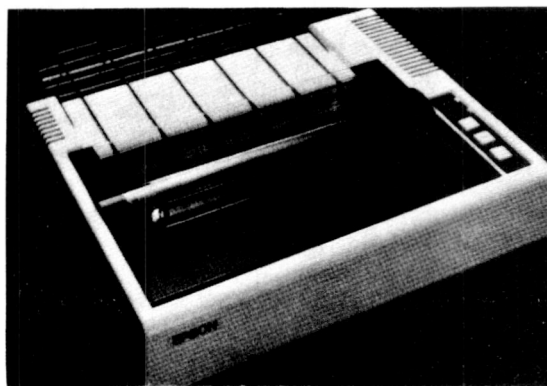
and

COMPUSTAR™

multi-user systems.

SOFTWARE FOR SUPERBRAIN

INTEGRATED ACCOUNTING SYSTEM. INSURANCE BROKERS PACKAGE. SALES/PURCHASE LEDGER. STOCK CONTROL. "DATASTAR" AND "MAILMERGE". SOLICITORS ACCOUNTING PACKAGE. "WORD-STAR" WORD-PROCESSOR. SALARIES AND WAGES; NOMINAL LEDGER AND ACCOUNTS.



EPSON

We produce tailor-made software for solving a wide range of problems.

SUPERBRAIN /
Mainframe interface
specialists.

CALL US FOR DETAILS:

GIBSON COMPUTER SERVICES

DUDLEY (0384) 236934

21 - 23 Holloway Chambers, 27 Priory Street,
Dudley, West Midlands DY1 1EU.

 **commodore**

**INDUSTRIAL
MICRO
SYSTEMS**



Qume

NorthStar 

 **apple II**

 **Anadex Ltd.**



MICRO FACILITIES

APPROVED

for
Commodore
Apple II
North Star Horizon
Industrial Micro Systems 5000
& 8000

APPROVED

by
Local Government
Central Government
National Laboratories
Maritime Research
Universities
Schools

APPROVED

by
Accountants
Importers/Exporters
Retailers
Manufacturers
Printers
Surveyors

WE WILL GET YOUR APPROVAL

Why? Because Micro-Facilities know that whether you are a large establishment or a small business you are going to need **help** and good **service**. We believe, and our hundreds of satisfied customers seem to agree, that the service we give is second to none.

Our service starts right from your initial contact. We will meet with you to discuss your requirements and your **business**, without blinding you with computer jargon. We will arrange for you to have a demonstration of one or more computers from our range together with programs to suit your particular needs. If a ready-made program is not suitable then we can analyse, design and program your particular procedures (we have nearly twenty years experience of doing this).

As a further service we are able to arrange both **leasing** and **financing** of your computer equipment.

Our service does not stop when you have purchased your system; to ensure the smooth transfer of your work we **train** you and your staff to use the computer and its programs in your own environment. As additional security we offer full **maintenance contracts**. Above all we will be available to give you genuine **after sales service**. Not for just one week or one month but everytime it is wanted.

Please contact us to discuss your problems and requirements, we offer you a lot more, but only charge the same. Our ability will give you peace of mind and confidence that the job will be done properly.

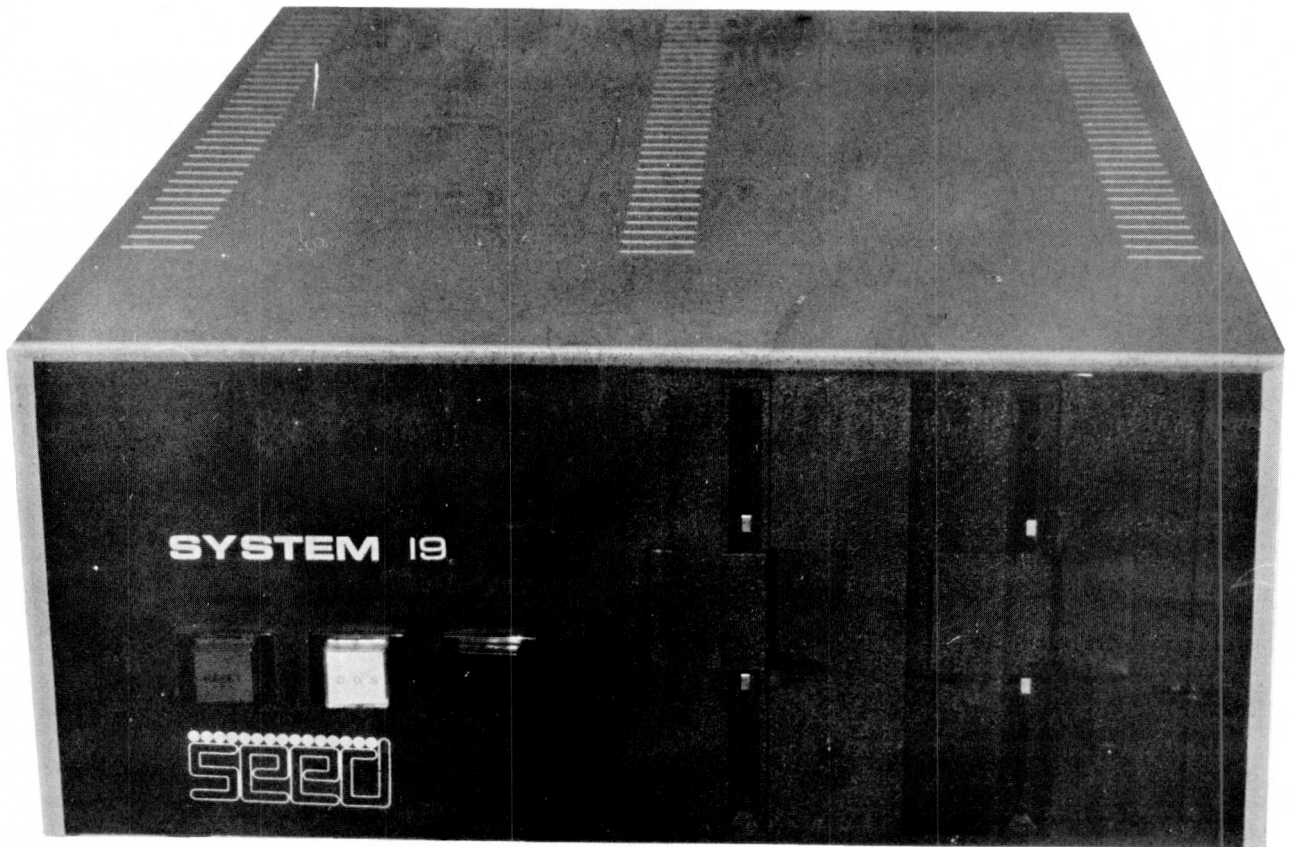
Central Computer & Telecommunications Agency Approved
Tenders from Local Authorities, Education and Government
Departments welcomed.

Micro-Facilities Ltd. 129 High Street,
Hampton Hill, Middlesex TW12 1NJ

01-941 1197 and 01-979 4546

**MICRO 
FACILITIES**

THE SEED SYSTEM *19*



+ OS-9

THE ULTIMATE COMBINATION OF HARDWARE AND SOFTWARE

6809 BASED PROCESSOR WITH 56K RAM

RUNNING MICROWARE OS-9 WITH 2.4 MEGABYTE FLOPPY DISK SYSTEM

TRUE MULTI-USER/MULTI-TASKING CAPABILITY

FOREGROUND/BACKGROUND TASKS

FAST BASIC INTERPRETER/COMPILER

EDITOR/ASSEMBLER

PRICES FROM £2375.00



STRUMECH

PORTLAND HOUSE, COPPICE SIDE,

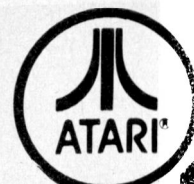
BROWNHILLS, WEST MIDLANDS.

TELEPHONE: BROWNHILLS 78151

TELEX 335243

MAPLIN for ATARI

AUTHORISED DEALER



The World-beating ATARI PERSONAL COMPUTERS

3 consoles available

Atari 400 with 8K RAM (AF03D) £295

Atari 400 with 16K RAM (AF36P) £340

Atari 800 with 16K RAM (AFO2C) £625

(expandable to 48K)

All consoles when connected to a standard UK colour (or black and white) TV set can generate the most amazing graphics you've ever seen.

Look at what you get:

- * Background colour, plotting colour, text colour and border colour settable to any one of 16 colours with 8 levels of illuminance!
- * Video display has upper and lower case characters with true descenders, double and quad size text and inverse video.
- * 57-Key keyboard (touch type on Atari 400) and four function keys.
- * Full screen editing and four-way cursor control.
- * 29 keystroke graphics and plottable points up to 320 x 192 (160 x 96 only with 8K RAM).
- * 40 character by 24 line display.
- * Extended graphics control and high speed action using a DMA chip with its own character set.
- * Player missile graphics.
- * Four programmable sound generators can be played individually or together and each has 1785 possible sounds playable at any one of eight volume settings, for game sounds or music.
- * Full software control of pitch, timbre and duration of notes in 4-octave range.
- * Four joystick or paddle ports, sounds output to TV.
- * BASIC cartridge and 10K ROM operating system and full documentation.

MORE HARDWARE

Atari 410 Cassette Recorder (AF28F)	£45
Atari 810 Disk Drive (AF06G)	£325
Atari 822 40-column Thermal Printer (AF04E)	£240
Atari 850 Interface (AF29G)	£120
Joystick Controllers (AC37S)	£13.95
Paddle Controllers (AC29G)	£13.95
16K RAM Memory Module (AF08J)	£65

MUCH MORE FOR ATARI COMING SOON

SOFTWARE

Lots and lots of amazing software for Atari available during June 1981.

- ★ Word Processor ★ VISI-CALC
- ★ ADVENTURE GAMES ★ Arcade Games
- ★ Trek Games ★ ASSEMBLER & DISASSEMBLER ★ FORTH ★ Teaching
- ★ 3D GRAPHICS ★ Character Set Generator

SEND S.A.E. NOW FOR OUR LEAFLET
XH52G available JUNE

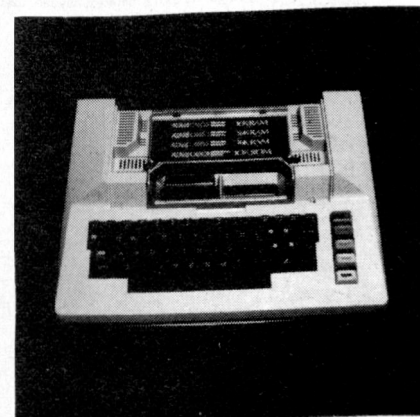
LE STICK

For Atari Computer or Video Game. Replaces standard joystick, but much easier to use. Internal motion detectors sense hand movements. Large pushbutton on top of Stick. Squeeze Stick to freeze motion. A MUST for SPACE INVADERS, STAR RAIDERS & ASTEROIDS. ONLY £24.95 (AC45Y)

Note: Order codes shown in brackets. Prices firm until August 30th 1981 and include VAT and Postage and Packing. (Errors excluded.)



Atari 400 Console



Atari 800 Console (with cover removed)

SPECIAL PACKAGE OFFER

Disk-based system for under £775!!
The Atari 400 Console
Special 32K RAM Module
Atari 810 Disk Drive
Disk Operating System
Documentation
Interconnecting Leads
And everything in "Look at what you get" list.
Can any other computer on the market offer all this at anything like this price?

VERSAWRITER

12½ x 8in. drawing board. Drawing on board is reproduced on TV via Atari with 32K RAM and Disk Drive. Closed areas may be filled in with one of 3 colours. Text may be added in any one of 4 fonts. Paint brush mode: select size of brush and paint away. Air brush mode: shade in your drawing - colour and density is up to you. Plus many more features. S.a.e. for price and further details.

MAPLIN

Maplin Electronic Supplies Ltd
P.O. Box 3, Rayleigh, Essex.
Tel: Southend (0702) 552911/554155

Demonstrations at our
shops from June 9th 1981.
See Atari at 284 London Road,
Westcliff-on-Sea, Essex.
Tel: (0702) 554000 and at
159-161 King St., Hammersmith W6.
Tel: 01-748 0926

NOW YOU CAN PLAY SUPER INVASION ON YOUR ZX80!



● TOTALLY FLICKER FREE

Absolutely no flicker. You don't need to press anything for the display to move!

● 3 LEVELS OF PLAY IN EACH GAME

From easy to dangerously difficult — you'll find it hard to resist the challenge time after time!

● MOVING GRAPHICS

No hardware modifications are necessary to get moving graphics. Just follow the instructions for cassette loading and off you go; no extra memory needed, uses the 4K ROM.

● MACHINE LANGUAGE

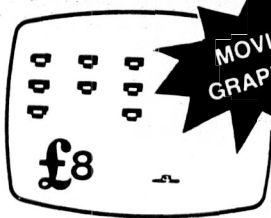
These programs are written in the computer's own language — only this way is it possible for continuous, flicker free action to occur.

● ALL PROGRAMS ON CASSETTE

Loads just like any other program on cassette. Each tape contains instructions on how best to load the cassette.

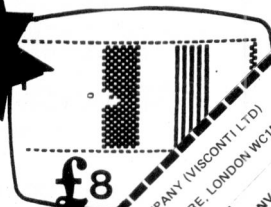
● FITS IK BASIC MACHINE

Amazing as it is, all these moving graphics programs fit into your basic IK Sinclair!



SUPER ZX80 INVASION

SUPER ZX80 INVASION is the machine language game you and your Sinclair have been waiting for. Cruel and crafty invaders have been spotted in battle formation ready to attack with your ship just below them! Quickly and skilfully you shift right and left as you carefully fire your lasers at them. But watch out — they are accurate! 3 levels from easy to almost impossible to beat. Added bonus — each cassette also has more sophisticated 2K version which will automatically reset and challenge you for hours!



DOUBLE BREAKOUT

You'll be amazed to see how difficult it is for you to break through the ZX80 DOUBLE BREAKOUT — and even more astonished to see this exciting game fit into your IK Sinclair ZX80! Try your skill on the easiest level because even with the most skilful bat control you'll find it hard to catch at the fastest level! Breaking through the first barricade is easy but don't be fooled for the second — it's much harder than you think! Two ball angles and curved bat will keep the excitement going for hours!

*** Order your games for New ROM now!!**

THE ESSENTIAL SOFTWARE COMPANY (VISCONTI LTD)
Company Address 47 BRUNSWICK CENTRE, LONDON WC1N 1AF
TEL 01-837 3154
Please send me ☐ OLD ROM ☐ NEW ROM
copies **DOUBLE BREAKOUT**.
I enclose cheque/postal order for £
Name: Address:
plus 50p post and pack

THE ESSENTIAL SOFTWARE COMPANY

BRINGS YOU

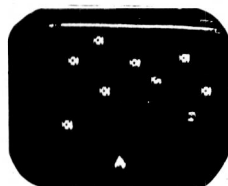
QUALITY PROGRAMS CHOSEN FOR THEIR SUPERB GRAPHICS AND SMOOTH ACTION

TRS 80

Video Genie

ZX80

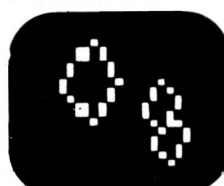
JUST ARRIVED
COSMIC FIGHTER WITH SOUND



Your fighter appears Below a convoy of aliens! If you destroy them another set appears who seem to be slightly cleverer than before! Soon your space station nears but before you can dock the station comes under attack! Survival is up to you! The excitement is just beginning!!

TRS80 Levels I & II 16K Tape £10
Video Genie 16K Tape £10

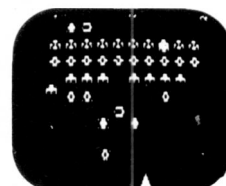
NEW
ASTEROID NOVA



Now the amazing ASTEROIDS arcade game for your TRS80! Your Ship is floating in the middle of an asteroid belt! Your only escape is to destroy them and the crafty alien spacecraft! Blast them with your laser, thrust, rotate or hit hyperspace to survive!

TRS80 Levels 1 & 11.16K Tape
Video Genie 16K Tape

GALAXY INVASION WITH SOUND



The newest and most exciting invaders type game yet! Cruel and crafty aliens attack Earth. You are the sole defender. As you fire your laser at the aliens they swoop down and bomb you. Exciting use of graphics! Must be seen.

TRS 80 Level 1 or 11.16K Tape £10
Video Genie 16K Tape £10



3-D ADVENTURES

A must for all adventure addicts! Walk down corridors depicted in full 3-D graphics. Look around to find the objects you need to survive. But beware! Monsters and Incredible Obstacles can lurk round every corner!

LABYRINTH TAPE £10 DEATHMAZE TAPE £10

THE ESSENTIAL SOFTWARE COMPANY
(Visconti Ltd.) 01-837 3154
47 Brunswick Centre, London WC1N 1AF

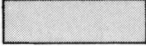
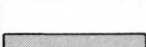
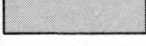
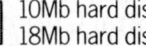
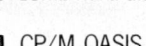
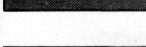
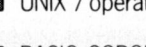
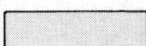
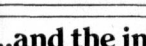
I have a microcomputer
☐ Please send me your software catalogue. I enclose a stamped self addressed envelope.
☐ Please send me
I enclose a cheque/postal order for £
(plus 50p post & packing)

Signature
Name
Address
Postcode

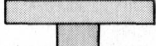
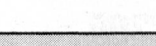
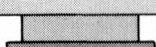
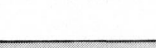
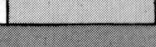
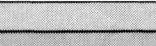
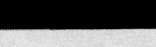
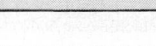
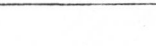
Your specialist subject is Onyx systems.

You have three minutes starting now.

The intelligence options...

	Onyx C8001 8-bit micro
	Onyx C8002 16-bit micro
	12Mb cartridge tape back-up
	64Kb RAM
	512Kb RAM
	128Kb RAM
	1032Kb RAM
	10Mb hard disc drive
	18Mb hard disc drive
	CP/M, OASIS, MOASIS, or UNIX 7 operating systems
	BASIC, COBOL, FORTRAN, UCSD PASCAL, MUMPS, C
	MARATHON relational DBMS

..and the intelligent applications.

	Onyx C8001 8-bit micro
	64Kb RAM
	10Mb hard disc drive
	CP/M operating system
	BASIC
	£5690
	Onyx C8001 8-bit micro
	128Kb RAM
	10Mb hard disc drive
	MOASIS
	UCSD PASCAL
	£6685
	Onyx C8002 16-bit micro
	256Kb RAM
	10Mb hard disc drive
	UNIX 7 (8-user)
	C BASIC/ UCSD PASCAL
	£11930
	Onyx C8002 16-bit micro
	512Kb RAM
	18Mb hard disc drive
	UNIX 7 (8-user)
	UCSD PASCAL
	MARATHON DBMS
	£16790
	Onyx C8002 16-bit micro
	1032Kb RAM
	18Mb hard disc drive
	UNIX 7 (8-user)
	UCSD PASCAL
	MARATHON DBMS
	£20610

"What gives you the power of a mainframe in a desk-top device?"
The Onyx C8002.

"Explain the advantages of its UNIX 7* timesharing operating system."

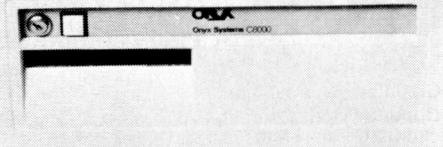
It enables up to 8 users to share files and compile or execute programmes written in BASIC*, COBOL, FORTRAN, UCSD PASCAL, MUMPS and C – concurrently and independently. On custom programming, UNIX 7 cuts costs and increases productivity enormously.

"Name the new database management system that can be used with the Onyx C8002 computer and describe its advantages."

MARATHON. It's a relational DBMS designed specifically for UNIX commercial users. It has everything that's needed to help systems designers and programmers cut costs and heighten applications reliability and expandability. Features include an interactive query language, an interactive data entry and maintenance programme, report writers, and audit trail and recovery programmes.

"Describe how Onyx computer users can get the power and versatility of mainframe network systems costing many thousands of pounds more."

By using OMNINET – a new low cost carrier-sense multiple-access network that can provide up to 80Mb of shared storage. It uses shielded twisted-pair cable for the interconnection of up to 64 microcomputers in a 4000-foot serial link.



"Name the other Onyx system, together with its operating system."

The Onyx C8001. It's ideal for 1-4 users and can operate under CP/M*, OASIS* and Multi-User OASIS (MOASIS).

"Explain the advantages of OASIS and MOASIS."

OASIS offers applications software developers an unrivalled range of development tools for fast, easy and practical creation of sophisticated software. MOASIS makes micros run like minis. File and Automatic Record Locking denies other users access to a record when someone is updating it; Logon Password and Privilege Level enables a systems manager to specify which programmes and files may be accessed by various individuals; and OASIS Re-Entrant BASIC means less memory is needed for practical operation.

"Which company in the U.K. has the technical expertise and service back-up to deliver the full potential of the Onyx C8000 series, MARATHON DBMS, and the OMNINET local network?"

There is only one – Keen Computers.

"How can you get more information?"

Fill in the coupon below.

Please send me details of:

- ☐ Onyx C8001 ☐ Onyx C8002
☐ Marathon relational DBMS ☐ Omnet

I am interested in Onyx with the following operating systems (please state).

**You can see us at the Microcomputer Show
Wembley, 29th-31st July 1981**

Keen Computers

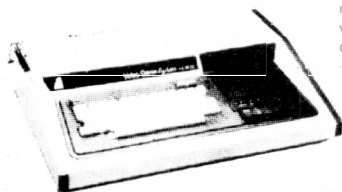


Name _____
Position _____
Company/Establishment _____
Address _____
Tel: _____

Please post to Keen Computers
Marketing Department, 5 Giltspur Street
London EC1A 9DE. Tel: 01-248 7307
ENQUIRIES FROM OEMs, DEALERS
AND OVERSEAS WELCOME.

THE Video Genie EG3000 Series

WITH *16K user RAM plus extended 12K Microsoft BASIC in ROM *Fully TRS-80 Level II software compatible *Huge range of software already available *Self contained, PSU, UHF modulator, and cassette *Simply plugs into video monitor or UHF TV *Full expansion to disks and printer *Absolutely complete - just fit into mains plug.



16K **£299** + VAT

GP80 The most compact 80 column impact graphic-dot printer available - at a very compact price

by seikosha

Graphics, Normal and Double-Width Characters can be printed on the same line. Pine Feed Tractor is equipped as standard.

Two Line-Feed Commands (1/6 and 1/9 inch)

Print on Plain Paper with two copies

Continuous Self-Inking Ribbon for easy handling

Centronics type Parallel Interface standard

Wide Range of Optional Interface Boards

Self-Test Programme standard



£225 + VAT

SUPERBRAIN

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application... General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is tops in its class.

320K £1850 700K £2400
1.5Mb £2750

COMMODORE COMPUTERS

PET 8K	£415
PET 16K	£525
PET 32K	£650
PET 8032	£895

DISK DRIVES

4040	£695
------	------

PRINTERS

EPSON TX80B (inc. I/F & cable)	£299
EPSON MX80T	£395
ANADEx DP8000	£495
ANADEx DP9500	£895
ANADEx DP9501	£995

VIDEO MONITORS

10" BLACK & WHITE	£85
10" GREEN SCREEN	£95

Aculab Floppy Tape

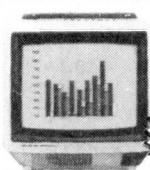
The tape that behaves like a disk.

Connects directly to TRS-80 level 2 keyboard. Operating and file handling software in ROM 8 commands add 12 powerful functions to level 2 BASIC. No buttons, switches or volume controls. Full control of all functions from keyboard or program. Maintains directory with up to 32 files on each tape.

for all TRS 80 & Video Genie owners

TRS80 version:	£165
Video Genie :	£170

Please add £10 Securicor delivery charge to all computers etc.
Plus 15% VAT on all prices.



Acorn Atom

Unique in concept — the home computer that grows as you do!

Special features include
*FULL SIZED KEYBOARD
*ASSEMBLER AND BASIC
*TOP QUALITY MOULDED CASE
*HIGH RESOLUTION COLOUR GRAPHICS

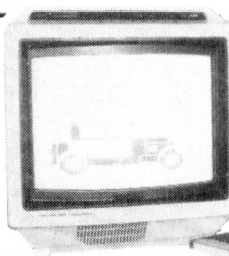
Simple to build, simple to operate. A powerful, full facility computer with all the features you would expect.

Just connect the assembled computer to any domestic TV and power source and you are ready to begin.

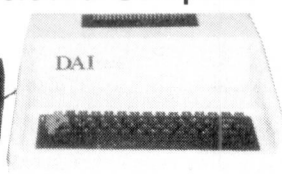
Full-sized QWERTY keyboard
6502 Microprocessor Rugged injection-moulded case 2K RAM
8K HYPER-ROM 23 integrated circuits and sockets Audio

cassette interface UHF TV output Full assembly instructions

£120 + VAT



The Second Generation Personal Computer



Highest performance - lowest price

- *48K (8080A)
- *16 Colours or shades of Grey
- *Multiple High Resolution Graphics Modes (64 x 71, 129 x 159, 255 x 335)
- *Character mode (60 x 24)
- *Split Screen Modes

- *Full ASCII Upper & Lower Character Set
- *Unique graphical — Sound Commands for Smooth Music, random frequencies & enveloped sound!

DAI Personal Computer

*RS232 I/F at only **£595** + VAT

Paper Tiger 460

The Paper Tiger 460 sets new standards by incorporating many features previously only available on units costing much more.

Features like a specially developed nine wire 'staggered column' head which overlaps the dots of each matrix character with just one pass of the printhead giving a dense, high quality print image without reducing the units 160 c.p.s. print speed.

It also offers a bi-directional logic seeking device to enhance its print optimisation characteristics and wide range of 'print versatility' features such as mono or proportional spacing, automatic justification, programmable horizontal and vertical tabbing, and 'fine' positioning for word processing applications.

Paper Tiger 560

£795 + VAT

The Paper Tiger 560 is the first printer which bridges the gap between conventional matrix and 'daisy wheel' types offering quality printing at a relatively low price.

Full 'width' 132 column printing at 160 c.p.s., a unique nine wire 'staggered' print head, bi-directional printing, an inbuilt tractor feed and a host of selectable features set it apart from ordinary matrix printers.

Plus for even greater versatility a full dot plot graphics facility if supplied which includes a 2K buffer.

£995 + VAT

Books & bits

Books Manuals

Diskettes — ribbons Paper

— chips (2114 x 2 1K) £4 pair.

RS232 to Centronics interfaces £40 etc. etc.

A variety of second-hand computer

equipment usually available,

spares, repairs and service.

MicroStyle

29 Belvedere, Lansdown Road, Bath.

Telephone: (0225) 334659. After hours: (0761) 33283.

New Showroom now open

MORE PRICE MAGIC ON MIRACLE MICRO NETWORKS!

When 2-64 micros share up to 72Mb of Corvus hard disc through Constellation host multiplexing, you get a Miracle – no less.

Miracle puts distributed data processing on tap, with each user station enjoying high-speed access and total flexibility. A Miracle can outperform a mini-network and save you money all along the line.

You can expand your network as your needs expand with many kinds of micros: Apple II and III, S100 North Star, Vector Graphic, Cromemco, Superbrain, Research Machines 380Z, TRS-80 I and II, DEC LSI 11 – and more to come.

In addition to his own dedicated computer and associated memory, each Miracle user has access to a central hard disc memory – normally twenty times faster than floppies – without interference from other users. Like computers can communicate with each other in the network and peripherals shared.

Traditional peripherals, such as printers and VDUs, and interactive devices like speech output, voice recognition, colour graphics, light pens and digitisers, can be linked up to give a Miracle system unrivalled configurability.

How a Miracle system works

Each Constellation host multiplexer links 2-8 micros in star configuration to 5Mb, 10Mb or 18Mb of Corvus hard disc drive. Up to 8 host multiplexers can be connected together, allowing up to 64 micros to use four disc drives for a total system capacity of 72 Mb.

Inexpensive back-up for the hard disc system is provided by the unique Corvus Mirror. It interfaces the data signals on the disc with a 100Mb capacity video



2-user from £5,709
4-user from £7,625
8-user from £12,707
16-user from £22,026

tape system; and the entire contents of a 10Mb disc can be archived in about 15 minutes.

Applications software

Miracle can make use of a comprehensive range of languages, from BASIC, COBOL and FORTRAN to PASCAL, ALGOL and APL.

PASCAL-written applications software packages include: Accounting Systems, Payroll and Stock Control (fully integrated with order processing/invoice generator); Addressing/Mailing; Database

Management; Incomplete Records; Job Costing; Time Records; Graphics; Critical Path Analysis.

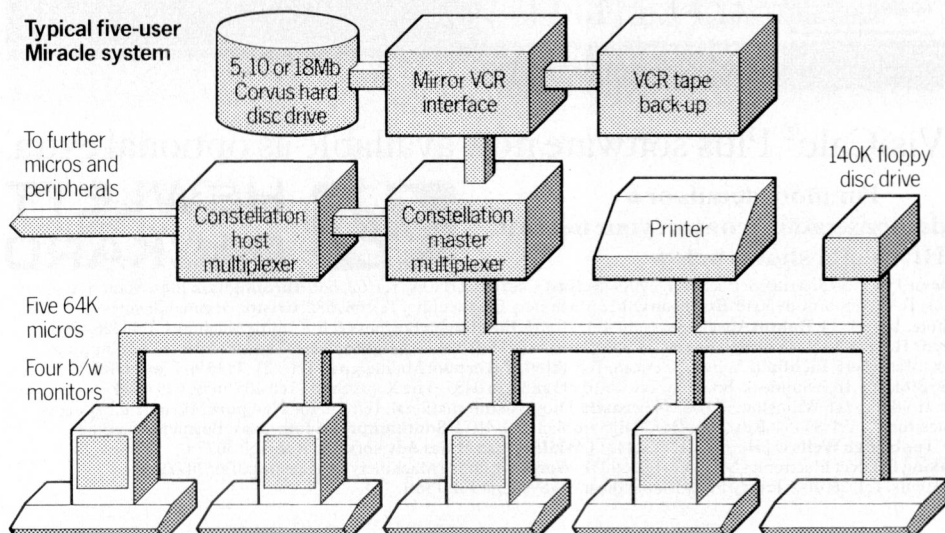
Come and see Miracle being put through its paces at our London or Nottingham showrooms. Phone now for an appointment or complete the coupon below.

London 01-248 7307
Nottingham 0602 583254

Keen Computers



Typical five-user Miracle system



Please send me details of:
 Miracle with the following micros

Applications software packages
 (please state)

Name _____
 Position _____
 Company/Establishment _____
 Address _____

Tel _____

Please post to Keen Computers,
 Marketing Department,
 5 Giltspur Street, London EC1A 9DE

ENQUIRIES FROM OEMs DEALERS AND OVERSEAS
 WELCOME. SPECIAL TERMS ARE AVAILABLE FOR
 EDUCATIONAL/GOVERNMENT DEPARTMENTS

Discover the full professional power of Hewlett-Packard's personal computer.

Now you can extend the HP-85's power simply by plugging in high-performance printers, plotters and flexible disc systems.

Power where you need it.

The HP-85 puts professional problem-solving power wherever you need it. There's a video display with high resolution and editing capability. A whisper-quiet thermal printer for hard copies of display graphics and alphanumerics. A magnetic tape unit with up to 217 K of storage per cartridge. And a complete keyboard, including eight keys you can define yourself. Powerful, easy-to-use features, thanks to HP's extended BASIC programming language.

Decide the peripherals you need.

HP's Interface Bus (HP-IB/IEEE-488) lets you add up to 14 peripherals or instruments. No need to write special operating programs - HP's peripheral ROMs do it for you.

New HP enhancement ROMs and modules give you access to 80 K bytes of operating system, without significantly reducing user memory. The HP 2631B printer means high-speed, high-quality printing. And the HP 7225 Graphics Plotter gives you high-resolution, publication-quality graphics on paper or film.

For extra memory storage, use the HP 82900 series of 5 1/4" flexible disc drives. Each drive gives you about 270 K bytes of formatted storage on double-sided, double-density discs. The operating system is in the Mass Storage ROM, leaving the HP-85 main memory free.

Behind the HP-85 computing system is the strength of Hewlett-Packard. Continuous commitment to quality. One-source service and support.



VisiCalc® Plus software now available as optional extra.

For more details or a demonstration, contact your nearest HP Dealer shown below.



**HEWLETT
PACKARD**

Contact your nearest dealer for a demonstration: **Aberdeen** Tyseal Typewriter Service, Tel: 29019. **Belfast** Cardiac Services, Tel: 625566. **Birmingham** John Mabon Assoc., Tel: 643 6351. **Bournemouth** South Coast Business Machines, Tel: Wimborne 893040. **Brighton** Office Machinery Engineering, Tel: 689682. **Bristol** Decimal Business Machines, Tel: 214093. **Cambridge** Cambridge Computer Store, Tel: 65334. **Dublin** Abacus Systems, Tel: 711966. **Edinburgh** Business & Electronic Machines, Tel: 226 4294. **Holdene**, Tel: 668 2727. **Glasgow** Robox, Tel: 221 8413/4. **Leeds** Holdene, Tel: 459459. **Leicester** Sumlock Services, Tel: 29673. **Leighton Buzzard** Co-ordinated Computer Systems, Tel: Heath & Reach 581/2. **Limerick** Abacus Systems, Tel: 43165. **Lichfield** Anglo-American, Tel: 481042. **Liverpool** Microdigital, Tel: 227 2535/6/7. **Rockcliff** Brothers, Tel: 521 5830. **London** Euro Calc, Tel: 739 6484, 636 8161, 405 3113; Sumlock-Bondain, Tel: 250 0505 and 626 0487; The Xerox Store, Tel: 405 5659, 629 0694. **Manchester** Automated Business Equipment, Tel: 432 0708. **Holdene**, Tel: Wilmslow 529486. **Newcastle** Thos Hill International, Tel: 739261. **Newport** Micromedia Systems, Tel: 59276. **Reading** CSE Computers, Tel: 61492; Sintrom Electronics, Tel: 85464. **Royston** (Herts) Electroplan, Tel: 41171. **Southampton** South Coast Business Machines, Tel: 22958. **Sunderland** Thos Hill International, Tel: 42447. **Tunbridge Wells** D J Herriott, Tel: 22443/4. **Wallingford** Midas Advisory Services, Tel: 36773. **Watford** Automatic & Electronic Calculators, Tel: 31571. **Woking** Petallect Electronics Services, Tel: 69032. **Worthing** Office Machinery Engineering, Tel: 207292. **CHANNEL ISLANDS:** **Guernsey** Professional Business Systems, Tel: 26011/2. **Jersey** Professional Business Systems Tel: 75611.

£19.99 A WEEK

to lease this mobile wordprocessing/
data processing system from CPS!

CPS Data Systems offer this special package:-
Commodore 8032, 4040, Olympia Scripta R/O
printer with PET interface and Wordpro 4 PLUS,
with software. The Wordpro 4 PLUS lets you
create, edit, file, update and simultaneously
output to the printer, giving remarkably
increased versatility. The system is mounted on
a mobile DataDesk which can function from any
13 amp power point.

* Lease based on a 3-year contract with 3
months initial payment. Leasing is subject to
approval by the Leasing Company. VAT extra.



**PREFER
TO PURCHASE?**

CPS Data Systems believe the
purchase price of £2,785
+VAT to be exceptional
value for money

SPECIAL OFFERS ON EQUIPMENT:-
OLYMPIA SCRIPTA R/O £806 + VAT
OLYMPIA SCRIPTA, keyboard version,
£990 + VAT

Purchase a SCRIPTA printer from CPS
and get the required interface FREE!

ACM DataDesks, Rutishauser Tractor
Feed and Cut Sheet Feeds are available
at extremely competitive prices.

INTERFACES AVAILABLE NOW FROM CPS:-

IEEE to parallel centronics (addressable) £64 + VAT
IEEE to Serial RS232 £72 + VAT
Serial RS232 to parallel centronics £72 + VAT

Contact Nick Ashburner today at



CPS (DATA SYSTEMS) LTD

Third Floor, Arden House, 1102 Warwick Road, Acocks Green
Birmingham B27 6BH. Tel: 021-707 3866

A member of the CPS Group

Your search for the right price stops here.



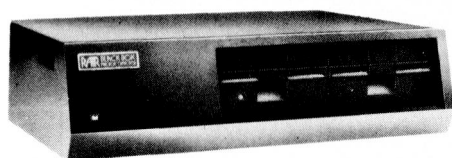
Pet

Well known for making short work of accounting, word processing, mailing lists. A great buy from NSC.



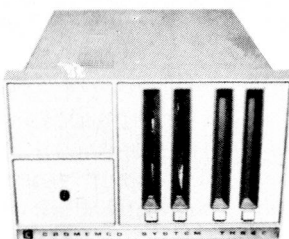
Apple

You know what the Apple system will do but you don't know the deal we're offering. Come and see for yourself.



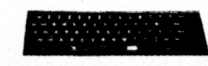
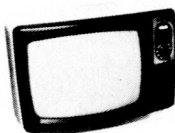
Rair

The exciting new 3/30 system offering 5 mb of fixed disc storage on brand new 5¼" Winchester drives. 64K Machine £4,313 incl. VAT. Full range of black box systems available. Rental terms available.



Cromemco

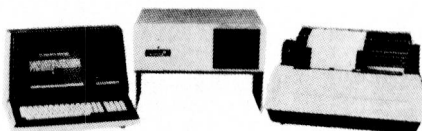
We can now supply the Cromix operating system for single and multi user working. The first big system operating system to be offered on a small system—the only system which offers up to 63K memory space per user.



Acorn Atom

Now available ex-stock. Special offer to ZX80 owners: We will take your ZX80 in part exchange for an Atom.

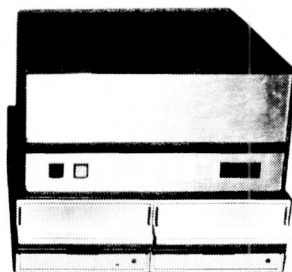
Used Bargain: Second hand ZX80's from £50.



North Star Horizon

A complete word processing system extendible from 32K-56K RAM, with up to four mini disc drives, 4MHz Z80A processor, serial and parallel I/O ports and extended BASIC. Full range of accounting packages available. You can lease this very popular system for as little as £25 per week.

Bargain Offers



South West Technical Products

56K 6809 based system, with twin 8" disc drives and Centronics 779 printer. From £3,163 incl. VAT, while stocks last. Keenest prices around on individual boards and peripherals.

48K Apple for £695

Buy a 16K Apple from NSC Computer Shops now and get 32K FREE.

After Sales Service

When you buy from NSC Computer Shops you have the opportunity to take advantage of a special service contract on favourable terms.

Order by post with confidence

Instead of calling personally at NSC Computer Shops you can send cash with order. Orders are despatched by carrier, please telephone for details of delivery charges.

BOOKS: Send s.a.e. for our full price list, or call in at our shop to see our wide range of publications.

All our prices are heavily discounted and therefore payment must accompany the order. Credit card payments will be accepted. Please quote credit card number and type of card.

WE WILL NOT BE KNOWINGLY UNDERSOLD.

NSC COMPUTER SHOPS

Computing to suit your size.

NSC Computer Shops, 29 Hanging Ditch, Manchester M4 3ES. Ring 061-832 2269 for further information.

NSC 24a [D]

Buying a printer is a serious business. We're adding a little fun...

The Great Centronics Tenth Anniversary Printer Offer

The first ever Centronics printer was shipped just ten years ago. Since then we have become the world's leading independent printer manufacturer, first choice for the professional user everywhere.

With everything set for an even more successful second decade, we would like our customers to join in a celebration of our 10th Anniversary, so we're making a very special offer on our highly praised Model 737 printer - **at a new low Anniversary price.**

The Fun



In conjunction with Hogg Robinson Travel we're offering to everyone who buys a 737 from a Centronics Qualified Retailer, before July 12th, a chance to win a luxury holiday for two in the **Bahamas** at a time of your own choosing. And there are lots of other exciting prizes to be won!



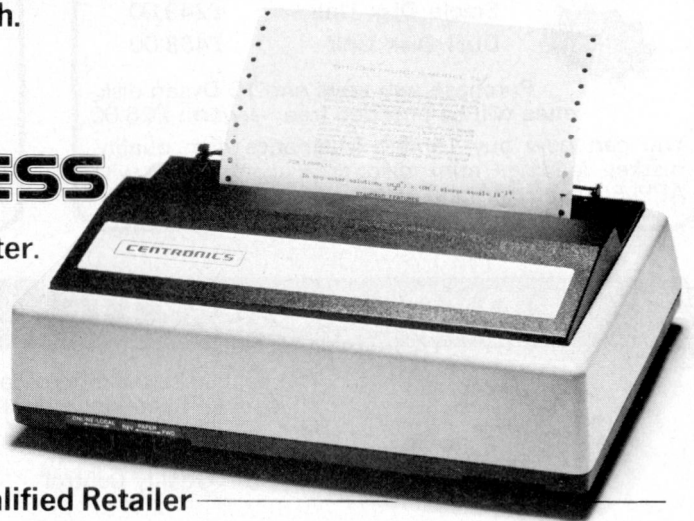
So get along to your nearest retailer displaying the 10th Anniversary sign for all the details. But hurry! The offer must close on July 11th.

The Serious Business

Centronics 737 Correspondence Quality Matrix Printer.

The ideal general purpose printer for the serious microcomputer user.

- Compact and attractive design
- Proportional and monospaced printing
- 40, 80, & 132 characters per line
- 80 characters per second print speed
- Roll, cut sheet and fanfold paper
- Bi-directional paper movement for super and sub-scripts



Your Centronics Qualified Retailer

Euro-Calc Ltd 128/132 Curtain Rd
London EC2 Tel: 01-729 4555

Henry's Radio 404 Edgware Rd
London W2 Tel: 01-402 6822

Informex 8-12 Lee High Rd
London SE13 Tel: 01-318 4213

Lion Micro Computers Lion House
227 Tottenham Court Rd
London W1 Tel: 01-580 7383

Newtronics 255 Archway Rd
London N6 Tel: 01-348 3325

The Xerox Store
84 Piccadilly 01-629 0694

77 High Holborn 01-405 5659

110 Moorgate 01-588 1531

Transam Components Ltd
59/61 Theobald's Rd London WC1
Tel: 01-405 5240

C & G Computer Group Ltd
36/38 Meadow St Weston S Mare
Avon Tel: 0924 417 724

C & G Computer Group Ltd
Tower House Fairfax St
Bristol Tel: 0272 28424

Decimal Business Machines
Decimal House Thomas Lane
Bristol Tel: 0272 294591

Comserve Computer Services
98 Tavistock St Bedford
Tel: 0234 216749

Jaxrest Linton House
Catherine St Aston Birmingham
Tel: 021 328 4908

Micro Associates
471 Lichfield Road Aston
Birmingham Tel: 021 328 4574

Westwood Computers Ltd
117-118 Tennant St Fiveways
Birmingham B15 Tel: 021 632 5824

Robert Harding Ltd
63 London Rd Brighton
Tel: 0273 608444

Interface Components
Oakfield Corner Sycamore Rd
Amersham Bucks Tel: 02403 22307

Cambridge Computer Store
1 Emmanuel St Cambridge
Tel: 0223 65334/5

C & G Computer Group Ltd
South Devon Hse Newton Abbot
Devon Tel: 0626 62101

Avrohurst 57 High St
Ingatstone Essex
Tel: 077 75 4022

The Computerist 642 London Rd
Westcliffe On Sea Essex
Tel: 0702 335 298

Screen Scene
144 St Georges Rd Cheltenham
Glos Tel: 0242 28979

Alpha Business Systems
89 Railway St Hertford
Tel: 0992 57425

Bromwall Data Services Ltd
25 Park St Old Hatfield
Herts Tel: 07072 60980

Compshop Ltd 14 Station Rd
New Barnet Herts
Tel: 01-441 2922

Local Business Technology Ltd
Wormley Hse 82 High Rd Wormley
Bromley Herts Tel: 09924 66157

Digital Devices Ltd
134 London Rd Southborough
Tunbridge Wells Kent
Tel: 0892 37977/9

D J Herriot 42 Camden Road
Tunbridge Wells Kent Tel: 0892 22443/4

Byte Shop Manchester
11 Gateway House Piccadilly
Manchester Tel: 061 236 4737

Independent Computer Engineering
16/18 Littleton Rd Ashford
Middx Tel: 07842 47171

Byte Shop Computerland
92A Upper Parliament St
Nottingham Tel: 0602 40576

Micro Age Ltd 53 Acton Rd
Long Eaton Nottingham
Tel: 06076 64264

Micro General 6 The Birchwoods
Little Heath Rd Tilehurst
Reading Tel: 0734 25226

Grist Business Services Ltd
West Quay Rd Southampton
Tel: 0703 39061

Aerco-Gemsoft
171 Church St Woking Surrey
Tel: 04862 22881

North Amber Ltd Great Oak Hse
Albany Close Esher Surrey
Tel: 0372 62071

Petelect Micro Computers
32 Chertsey Rd Woking Surrey
Tel: 048 62 63901/68497

Business & Leisure Microcomputers
16 The Square Kenilworth
Warwickshire Tel: 0926 512127

Catel 30 Kings Road
Harrogate N Yorks
Tel: 0423 65165

Huddersfield Computer Centre
4 Cross Church St Huddersfield
Yorks Tel: 0484 20774

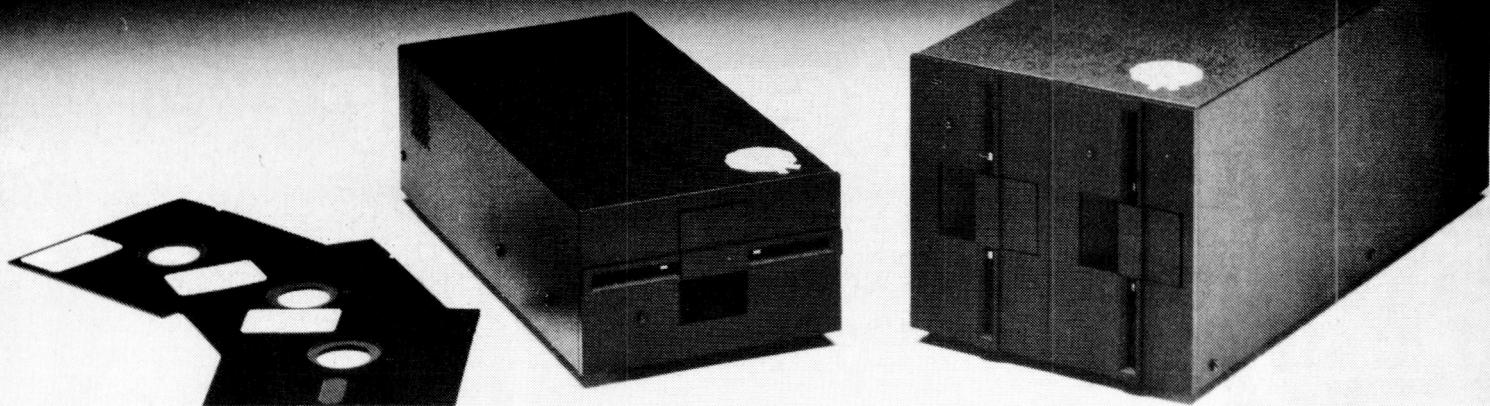
Scotbyte Computers Ltd
Thain Hse 226 Queensferry Rd
Edinburgh Tel: 031 343 1005

CENTRONICS®

Centronics Data Computer (UK) Ltd., Victoria Way, Burgess Hill, Sussex RH15 9NU Telephone 04446-45011 Telex: 877801

APPLE II COMPATIBLE DISC DRIVES

**TANDON
MAGNETICS**



**A complete range of professional floppy disc products
from the industry leaders....**

APPLE II DISC DRIVES



Single Disk Unit	£249.00
Dual Disk Unit	£488.00

Purchase two units and 10 Dysan diskettes will be provided free — worth £26.00

You can now buy Tandon Magnetix high quality, market leading, mini disc drive compatible with APPLE's controller and software.

TRS 80/VIDEO GENIE DISC DRIVES

Dual Units	— 40 Tracks	— £399.00
	80 Tracks	— £549.00
Single Units	— 40 Tracks	— £219.00
	80 Tracks	— £289.00

Move up market with Tandon Specifications, Double Density capability, 40 or 80 tracks and step rates as low as 3m secs track to track. Also interfaces to Superbrains, Horizons, Zenith, SWTP, Heathkit, etc.

DYSAN DISKETTES — Guaranteed Delivery



The best diskettes money can buy — approved by all leading manufacturers of floppy disc drives for

- Durability
- Data Reliability
- Quality Control

Apple
TRS 80 Tks.
TRS 80 80 Tks
Superbrain S.D. Supplied in packs of 10
Superbrain D.D.
Cromenco Z2
Cromenco 3

SERVICE — TECHNICAL SUPPORT — DRIVE MAINTENANCE



Our OASIS 820 is a non dedicated floppy disc drive and general purpose peripheral exerciser — for your service Engineers. Send for details.

We also offer a 24 hour repair facilities for Tandon Floppy Disc Drives.

All prices exclude V.A.T. and delivery charges.
DEALER ENQUIRIES WELCOME.

**HAL COMPUTERS
LIMITED**

133 Woodham Lane New Haw
Weybridge Surrey KT15 3NJ
Tel: Weybridge (0932) 48346/7
Telex: 8813487

The unique Computer Supermarket brings you computer hardware at cash-and-carry prices

SHARP, COMMODORE, TEXAS, TANGERINE EQUIPMENT

Fully tested before despatch, or collection complete with instruction manuals, tapes, fitted 13amp plugs.

SHARP EQUIPMENT

Model	User Ram	exc VAT	inc VAT
MZ80K	20K Ram	399.00	458.85
MZ80K	36K Ram	435.00	500.25
MZ80K	48K Ram	499.00	573.85
MZ80FD	Floppy Disc	589.00	677.35
MZ80P	Printer	385.00	442.75
MZ801/0	Input/		
	Output Unit	87.00	100.05

FREE LEDGER & STOCK CONTROL PROGRAM WITH EVERY COMPLETE SHARP SYSTEM, i.e. 48K Sharp, Twin Floppy Disc, Printer & I/O Unit.

PC1211	95.00	109.25
CE122	70.00	80.50

COMMODORE EQUIPMENT

Model	User Ram	exc VAT	inc VAT
4008	40 Col. PET		
	8K Mem	378.00	434.70
4016	40 Col. PET		
	16K Mem	462.00	531.30
4032	40 Col. PET		
	32K Mem	585.00	672.75
8032	80 Col. PET		
	32K Mem	755.00	868.25
4040	347K Disk	585.00	672.75
8050	1M Byte Disk	755.00	868.25
4022	Printer	357.00	410.55
8024	Printer	975.00	1,121.25
8026	Printer	835.00	960.25
C2N	Cassette	47.00	54.05
VIC	Personal		
	Computer	160.00	184.00

TEXAS EQUIPMENT

TI-99/4	345.00	396.75
---------	---------------	--------

(New lower price NOW for PAL European version)

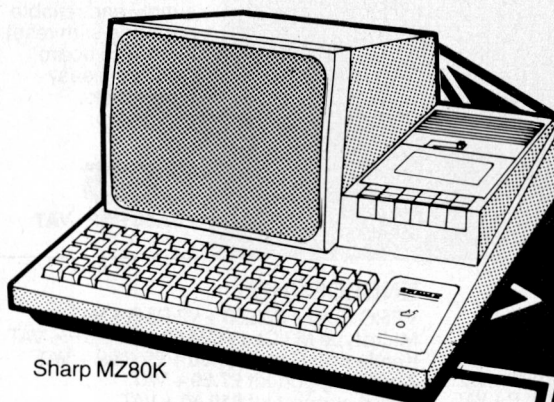
TANGERINE EQUIPMENT

Tantel Prestel Adaptor **170.00** 195.50
Full colour output. Connects to any TV. Full British Telecom approval. Requires British Telecom 96A jack plug. Gives access to massive home computer base. Information from Mortgages to Theatres, Stocks to Holidays.

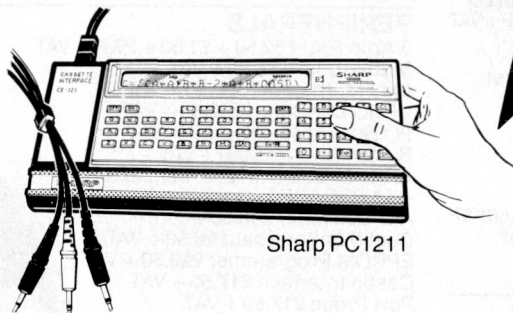


Telephone us for further information on ease of installation. Credit facilities are readily available.

OPEN SOON New 1,500 sq. ft. Computer Supermarket premises opening shortly.
Oakley Hay Industrial Estate, Corby.



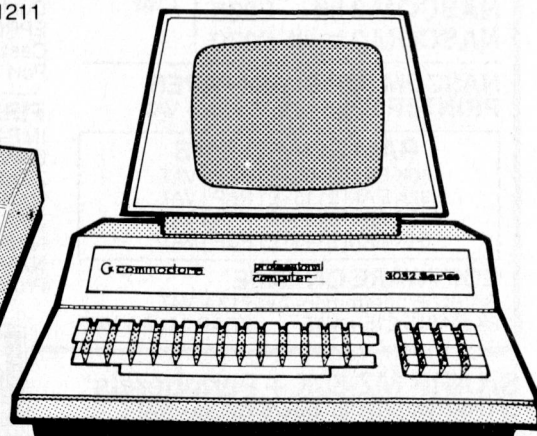
Sharp MZ80K



Sharp PC1211



Tantel Prestel adaptor



Commodore PET4032

All goods sold with full manufacturer's warranty and subject to conditions of sale (available on request). ALL MACHINES ARE FULL UK STANDARD. Shipment arranged anywhere in UK

COMPUTER SUPERMARKET

COMPUTER SUPERMARKET LTD (An associate company of HB Computers Ltd)

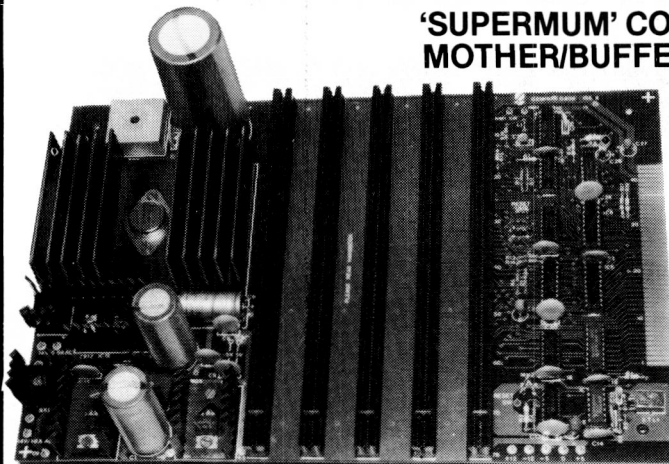
Registered Commodore and Sharp Dealer

3rd Floor, Douglas House, Queens Square, Corby, Northamptonshire.

Telephone (05366) 62571 Telex COMPSU 341543/4

interface components

NASCOM SYSTEMS & PERIPHERALS



'SUPERMUM' COMBINED MOTHER/BUFFER/PSU BOARD

A 12 x 8 piggy-back board for the Nascom 1, it contains a five-slot motherboard, quality 5A power supply and reliable buffering with reset jump. The board facilitates easy floppy disk expansion.

KIT
£85
+ £3.50 P&P + VAT

FLOPPY DISC SYSTEM

Built and tested stand alone unit with 1/2 drives for both Nascom 1 & 2.

Single drive CP/M (160K) £450 + £4 P&P + VAT
Double drive CP/M (320K) £640 + £4 P&P + VAT
Single drive D-DOS system .. £395 + £4 P&P + VAT
(enables existing NAS-Sys software to be used)
Spare drive £205 + £2 P&P + VAT
Verbatim Diskettes £3.75 + VAT each
10 for £32 + VAT

Nascom 1 owners: Add £10 + VAT to CP/M prices above for Reset Jump Kit.

Dispen text editor for CP/M system
£43.25 + 75p P&P + VAT.

NASCOM 1 kit	£125	} + £1.50 P&P + VAT
NASCOM 1 built	£140	
NASCOM 2 kit	£225	
NASCOM 2 built	£270	

NASCOM IMP PLAIN PAPER PRINTER

£325 + £2.75 P&P + VAT

RAM BOARD KITS

16K RAM £100 + £1 P&P + VAT
32K RAM £115 + £1 P&P + VAT
48K RAM £130 + £1 P&P + VAT
64K RAM £145 + £1 P&P + VAT

SOFTWARE ON TAPE

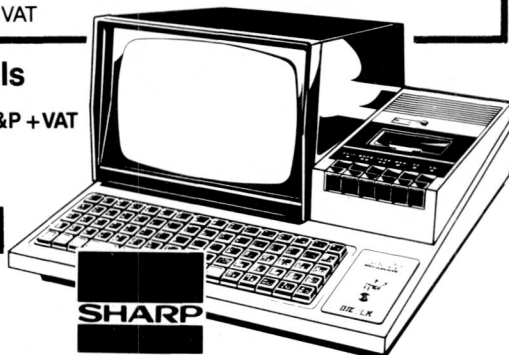
BASIC Programmers Aid £13 + VAT
8K BASIC £15 + VAT ZEAP 2 £30 + VAT

SHARP MZ-80K + Peripherals

Bi-Directional Serial Board £99.50 + VAT
MZ80FD (twin floppies 208K) £675 + £5 P&P + VAT
MZ80P3 Printer £425 + £5 P&P + VAT
MZ80 I/O Interface £99 + £2 P&P + VAT
CP/M 2.2 £200 + VAT

SPECIAL INTERFACE OFFER

48K MZ-80K SYSTEM
£460
+ £10 carriage + VAT



SHARP

SHARP PC-1211 POCKET COMPUTER

The PC-1211 uses BASIC and has up to 1424 program steps. 80 character input line with full editing facilities, 18 user definable keys, 24 character alpha-numeric LCD display. Optional cassette interface is available. PC-1211 is battery-operated, has auto power off function and maintains all programs and data in its memory even after the power has been turned off.

Printer/Cassette Interface £75 + VAT.
£86.92
+ £1 P&P + VAT

CENTRONICS MICRO PRINTERS

High performance - Low cost
737 - £395 + £3 P&P + VAT.

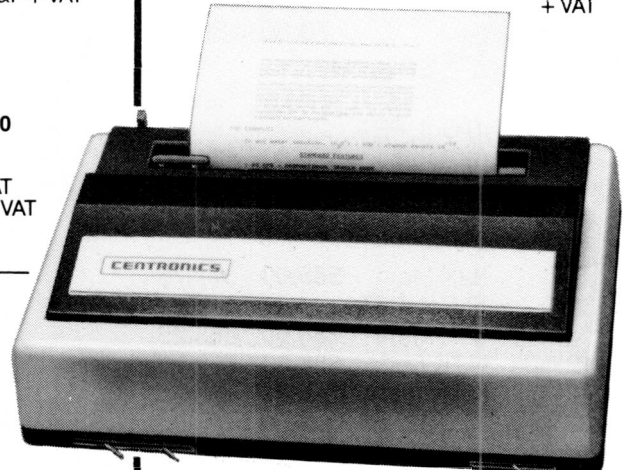
737 Dot Matrix Printer runs at 80cps (proportional) or 50cps (monospaced) giving text processing quality print. This new printer is capable of printing subscripts and superscripts.

730 - £295 + £3 P&P + VAT.

730 Dot Matrix Printer can print 10cpl or 16.5cpl at 100cps and 165cps respectively.

Both printers have 3-way paper handling and parallel interface as standard. RS 232/V24 serial interface is optional.

Fanfold paper (2000 sheets) £18 + £2.50 P&P + VAT



MICRO MART

Voltage Regulators

T0220 1 amp
+ 5, + 12, + 15, + 24V. 80p + VAT
- 5, - 12, - 15, - 24V. 65p + VAT

T03

1A + 5V LM309K 50p + VAT
3A + 5V LM323K £3.50 + VAT
5A + 5V 78H05 £5.50 + VAT

ICs

EPROMs 2708. £3.50 + VAT
EPROMs 2716. £5.50 + VAT

Memories

21L02 £0.80 + VAT

4027 £0.70 + VAT

4116 £2.00 + VAT

4118 £10.00 + VAT

2114 £3.00 + VAT

Z80 Devices (4MHz 'A' version)

MK3880 £8.00 + VAT

MK3881 (PIO) .. £5.00 + VAT

MK3882 (CTC) .. £5.00 + VAT

Also extensive range of standard and LS TTL, CMOS and linear ICs, plus other semiconductors, in stock. Send for list.

Unless otherwise stated add 50p P&P to all orders.

Prices correct at time of going to press.

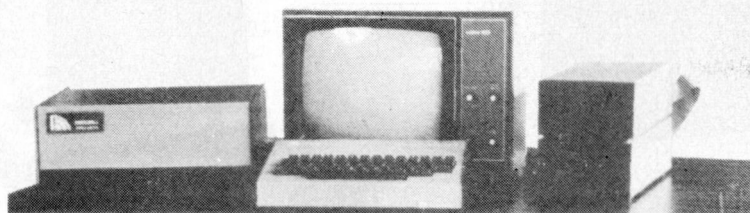
*New Interface catalogue now available on request. Access and Barclaycard accepted.

INTERFACE COMPONENTS LTD.

OAKFIELD CORNER, SYCAMORE ROAD, AMERSHAM, BUCKS HP6 6SU

TELEPHONE: 02403 22307. TELEX 837788

EXPLORER-85 COMPLETE BUSINESS SYSTEM AT A FANTASTIC PRICE



**64K COMPUTER — VDU —
TWO 8" DRIVES —
PRINTER — CP/M 2.2 —
EXTENDED MBASIC**

£2900.00

All you need to run your business

We can supply software to suit your particular requirements

EXPLORER-85 COMPUTER Kits Start at £85

**8085A cpu — S100 Based System
Designed for maximum Flexibility**

PROBABLY THE MOST EXPANDABLE KIT ON THE MARKET TODAY.

A COMPUTER FOR YOUR REQUIREMENTS TODAY AND TOMORROW BE IT BEGINNERS KIT:

OEM CONTROLLER: OR FULL DISC DRIVE SYSTEM

EXPLORER-85 NOT THE CHEAPEST, JUST THE BEST

8085A cpu — S100 slots (expandable to 6) — Powerful 2k Monitor — 4K RAM (expandable to 64K) —
8k Microsoft Basic — Speed 3.1MHz — 4.8bit I/O Ports — 1.6bit, I/O Port — 14bit Binary counter — All
programmable — Stand alone Keyboard Terminal — 64/32 characters 16 lines — upper & lower case —
Full cursor control — Power supply unit — NO EXTRAS NEEDED

4K system complet kit **£327**; Assembled Uncased **£402**; Assembled & Cased **£502**

16K system complet kit **£410**; Assembled Uncased **£485**; Assembled & Cased **£585**

Limited Budget? You can purchase explorer 85 in sub kits starting from £85 for the Motherboard Level 'A'.

EXPAND YOUR SYSTEM WITH 8" DRIVES

8" Control Data Corp Professional Drive

* LSI Controller * Write protect * Single or Double
density * Capacity 400K Bytes (SD) 800K Bytes
(DD) unformatted * Access time 25ns. **Price £350**

DISC CONTROLLER I/O 5100 CARD

Controls up to 4 Drives * 1771 ALSI (SD) floppy disc
controller * On board data separator (IBM com-
patible) * 2716 PROM socket included for use in
custom applications * On board crystal controlled *
On board I/O baud rate * Two serial I/O ports *
Autoboot to disc system when system reset *
Generators to 9600 baud * Double sided PC board
(glass epoxy). **Price £150**

DISC DRIVE CABINET WITH POWER SUPPLY

De Luxe steel cabinet to house single drive with
power supply unit to ensure maximum reliability and
stability. **Price £79**

DRIVE CABLE SET UP FOR TWO DRIVES

Price £19

64K 'SJ64K' S100 DYNAMIC RAM CARD

We offer you ... Hidden refresh ... fast performance
... lower power consumption ... latched data out-
puts ... 200ns 4116 RAM's ... on board crystal ... 8K
bank selectable ... fully socketed ... solder mask on
both side of the board. Designed for 8080, 8085 and
Z80 bus signals ... works in Explorer/85, Tuscan,
Horizon Sol, as well as all other well-designed S100
computers.

Computers			Computers		
	Kit	W/T		Kit	W/T
16K	£149	£169	48K	£239	£259
32K	£194	£214	64K	£284	£304
			16K upgrade kits		
			£45		

16K upgrade kits
£45

SOFTWARE

CP/M 1.4 £75 — CP/M 2.2 £98.00
Microsoft extended MBasic £155

Now-Break Through The 64K Micro-Memory Limit! 'SS16K'

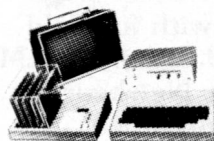
Bank Selectable 16K Static RAM

Don't buy any more antique RAMs (RAM without bank select) — now there's
Netronic's new SS16K board featuring a universal software bank select system.
SS16K is capable of addressing 2,048 different banks. With SS16K boards you can
add memory beyond the 64K limit, or expand to a multi-terminal system.

LOOK AT THESE FEATURES:

- 300 NS, low power 2114's
- Software Bank Selector — Universal decoder works with Cromenco, Alpha Micro, Netronics, most other systems, or your design. Onboard dip switches: Bank Select Enable; Reset Enable; Reset Disable; Port Address; Port Data.
- All Inputs And Outputs meet the proposed IEEE standards for the S100 bus.
- 4.0 MHz Operation.
- Schmitt Trigger Buffer on all signals for maximum noise immunity.
- Addressable On 16k Boundaries, 0-64k, dip switch selectable.
- Phantom Option, dip switch selectable.
- PWR/MWRITE Option, dip switch selectable.
- LED Indicator to display status.
- Glass Epoxy PC Board with gold-plated contacts and double-sided solder mask.
- Fully Socketed.
- Four Separate Regulators for maximum stability.
- £149 Kit: Assembled & Tested £175.

THE ELF11 IF YOU REALLY WANT TO UNDERSTAND COMPUTERS THEN ELF11 for YOU



Basic Specification
RCA COSMAC 1802 cpu — ¼ K RAM expand-
able to 64K — DAM — Interrupt — 16 registers
— Fully Decoded Hex Keypad — Dual 7 segment
display — Crystal clock — Onboard regulation —
1861 Graphic Chip — 5 slot expansion bus —
Double sided plated through PC Board.

ELF11 is Ideal for Beginners — Engineers —
Industry — Scientific and Educational purposes

SPECIAL OFFER £49.95

You will LEARN to program in Machine code and really
understand computers, from there you can expand it to meet
your requirements upto 64K RAM working in Basic level 111
Suggested Starters Pack:— ELF11 kit + RF Modulator +
T. Pitmans Short Course for £56.70

ELF11 EXPANSION. We carry a full range of expansion
kits — HARDWARE — FIRMWARE — SOFTWARE —
MANUALS. Send S.A.E. for brochures.

NOW AVAILABLE — FULL BASIC LEVEL 111 + RPN Maths
package COMING VERY SHORTLY — EPROM BURNER

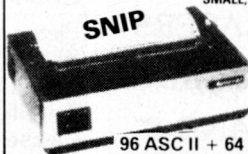
10" MONITOR £79.95

IDEAL FOR APPLE NASCOM
U.K. 101, ETC.

Designed for monitoring computers,
closed circuit TV and Video
Tape Recorders
10" black and white video monitor
10 MHz band width
High quality metallic cabinet
• Dimensions: 9" x 9" x 9 1/2"
Trade Enquiries Welcome

Oki Microline 80

SMALL, LIGHT QUIET MATRIX PRINTER



UNBEATABLE
VALUE AT
£299

40, 80 or 132 cols.
6 or 8 lines per inch.

96 ASC II + 64 graphics character set
with Centronics compatible interface
(Serial Interface £75 extra)

Centronics 737 LETTER QUALITY PRINTER

AT ONLY £399



* Dot Matrix: 7 x 9 * Paper
Handling: 3 way * Pitch: 5, 10 or 16
characters per inch * Speed: 80
characters per second proportional/
50 characters per second
monospaced * Line Length: 40, 80
or 132 characters * Standard Inter-
face: Parallel
(Serial version £429)

SEND SAE FOR COMPREHENSIVE BROCHURE

Please add VAT to all prices. P&P extra. Please make cheques and postal orders payable to
NEWTRONICS or phone your order quoting BARCLAYCARD, ACCESS number.

We are open for demonstrations and Sales. Monday-Saturday 9.30 a.m.-6.30 p.m. Near,
Highgate Underground on main A1 into London.

Newtronics

255 ARCHWAY ROAD,
LONDON, N.6 TEL: 01-348 3325



ELECTRONIC BROKERS LTD

VDU PRICES

SHATTERED



Hazeltine 1000

The low, low priced teletypewriter—compatible video display terminal with 12" screen (12 x 80) 64 ASCII alphanumeric and symbols. Full/Half Duplex. RS232.

£199

All equipment reconditioned, unless otherwise stated.



BRAND
NEW.



Hazeltine 2000

The world's largest-selling teletypewriter—compatible video display terminal. Features include: 12" screen (74 x 27) 64 alphanumeric and symbols. 32 ASCII control codes. Switch-selectable transmission rates to 9600 baud. Three switch-selectable operating modes full-duplex, half-duplex or batch. Direct cursor addressability. Dual-intensity video. Tabulation. Powerful editing capability. Remote keyboard. Selective or automatic roll-up. RS232.

£299

Low cost matrix printer.

Ideal for Microprocessor users such as Hobbyists & Educationalists or for any low-budget application.

*Full upper/lower case ASCII PLUS GRAPHICS Mode.

*80-column printing with adjustable tractor feed.

*30 cps print-speed with 1-line buffer.



Modular one basic

Now with Upper & Lower Case. 12" screen (24 x 80). XY cursor addressing 64 ASCII alphanumeric & symbols. Dual intensity detachable keyboard. Choice of 8 transmission rates up to 9600 baud. RS232. Range of options including printer port (£70.00).

£399

Modular one edit

All the above plus full edit capability, tabulation, 8 special function keys + many other features. **£695.00** POLLING MODELS also available—P.O.A.

*Standard and Double-width characters (12 cpi and 6 cpi)

*Standard parallel (Centronics-type) interface.

*Optional Interfaces available for RS 232, IEEE 488, Tandy, PET, Apple II

ONLY £199 plus carriage & VAT (mail order total £297.85).

Electronic Brokers Ltd., 61/65 Kings Cross Road, London WC1X 9LN. Tel: 01-278 3461. Telex 298694

New Bear

Computing Store Ltd

BETTER PRICES!
BETTER DELIVERY!
WIDEST RANGE OF
SOFTWARE

For the best deal
from the largest
sharp dealer
phone Newbear
(0635) 30505

Many unique products
Zen/Listings/Word Proc.

Apple
II plus



For ex-stock delivery
12 months warranty



MZ-80K

ACORN

PROM PROGRAMMERS

PROM ERASERS

KEYBOARDS

5 1/4 AND 8"
DISC DRIVES

WIDEST RANGE
OF BOOKS IN U.K.

and Bear care
Bear Bargains

NORTH
STAR

★ HORIZON

Installed on your site with full field
service anywhere in U.K. fully C.P.M.
compatible. Chosen by Newbear for
its reliability and performance.

64K Dual Drive Quad £1995.00

North Star Horizon

Newbury Laboratory 7009 terminal £795.00

Citoh8300 R.M. Printer £499.00

CPIM 2.2. £95.00

Please send urgently:

Sharp ☐

North Star Horizon ☐ Cat. ☐

Booklist ☐ Citoh ☐ N.L. Terminals ☐

Please contact me ☐ Phone No.

Name

Address

B

NEWBear COMPUTING STORE LTD. (HEAD OFFICE)

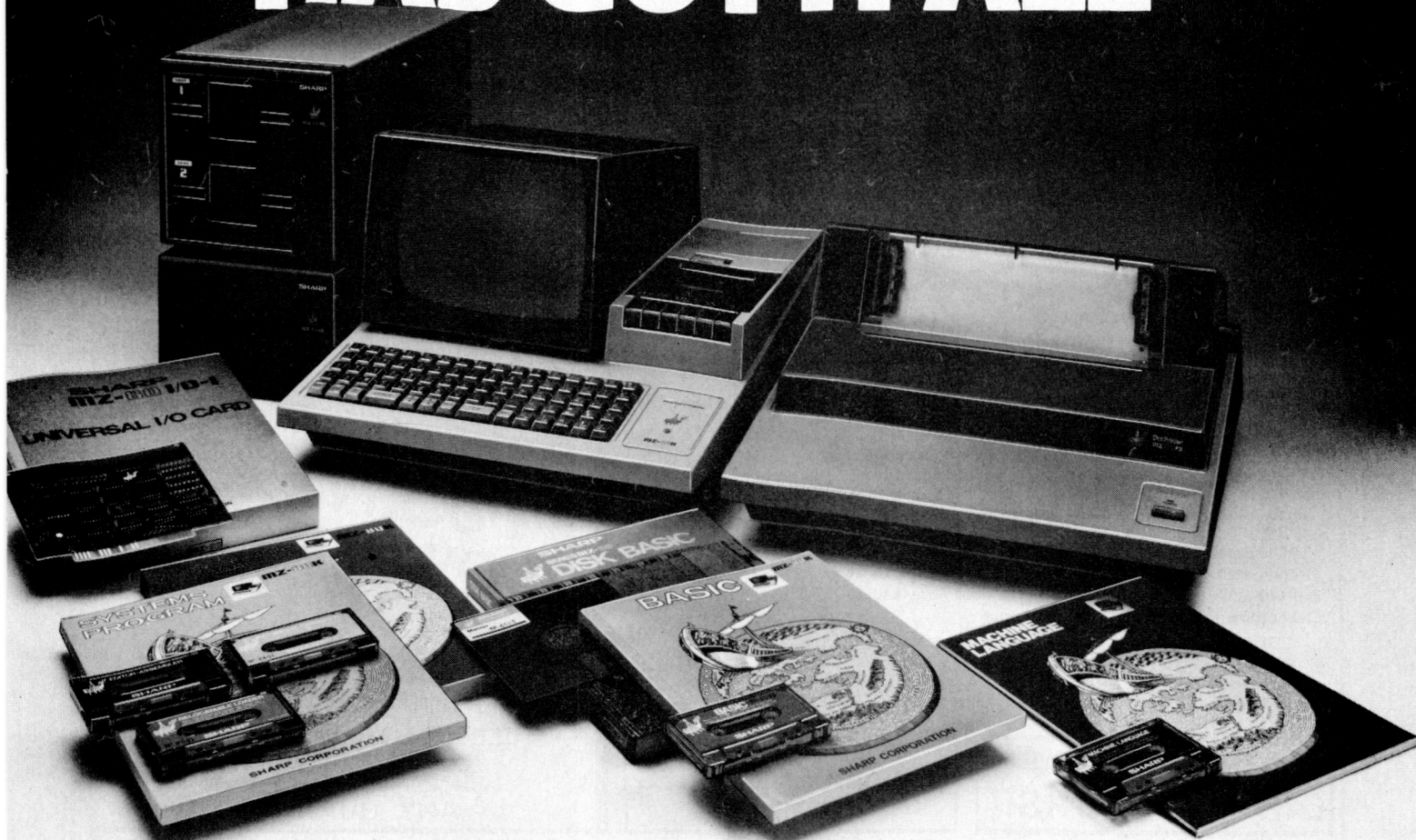
40 BARTHOLOMEW STREET, NEWBURY, BERKS

TEL. (0635) 30505 TELEX 848507 NCS

FIRST FLOOR OFFICES, TIVOLI CENTRE, COVENTRY ROAD,
BIRMINGHAM. TEL. 021 707 7170

220-222 STOCKPORT ROAD, CHEADLE HEATH, STOCKPORT.
TEL. 061-4912290

THE SHARP MZ-80K HAS GOT IT ALL



Since its introduction the Sharp MZ-80K has proved to be one of the most successful and versatile microcomputer systems around. Sharp now have a comprehensive range of products ready to make the powerful MZ-80K with its Printer and Disc Drives even more adaptable.

Products include: - Universal Interface Card, Machine Language and Z-80 Assembler packages, CP/M* plus a comprehensive range of software.

*Trade mark of Digital Research Ltd.

You'll find all the help and advice you need about the MZ-80K at your Specialist Sharp Dealer in the list below.

If there is no dealer in your area, or if you require any further

information write to:-
Computer Division,
Sharp Electronics (UK) Ltd.,
Sharp House, Thorp Road,
Newton Heath,
Manchester M10 9BE.



Computers that talk your language.

GET IT ALL HERE ...

AVON
BCG SHOP EQUIPMENT LTD
Bristol, Tel: 0272 425338
DECIMAL BUSINESS M/Cs LTD
Bristol, Tel: 0272 294591
BEDFORDSHIRE
H.B. Computers (Luton) Ltd
Luton, Tel: 0582 416887
BERKSHIRE
Newbear Computing Store Ltd
Newbury, Tel: 0635 30505
BIRMINGHAM
Camden Electronics
Small Heath, Tel: 021-773 8240
E.B.S. Ltd
Birmingham 1, Tel: 021-233 3045
Electronic Business Systems Ltd
Birmingham, Tel: 021-384 2513
Jax Rest Ltd.,
Birmingham, Tel: 021-328 4908
Newbear Computing Store Ltd
Birmingham B26, Tel: 021-707 7170
BUCKINGHAMSHIRE
Interface Components Ltd
Amersham, Tel: 02403 22307
CHESHIRE
Charlesworth of Crewe Ltd
Crewe, Tel: 0270 56342
Cash Register Services
Chester, Tel: 0244 317549
Cheshire Computer Services Ltd
Levenshulme, Tel: 061-225 4763
Fletcher Worthington Ltd
Hale, Tel: 061-928 8928
Newbear Computing Store Ltd
Stockport, Tel: 061-491 2290
Ors Group Ltd
Warrington, Tel: 0925 67411

CLEVELAND
Hunting Computer Services Ltd
Stockton-on-Tees, Tel: 0642 613021
DERBYSHIRE
Lowe Electronics Ltd
Matlock, Tel: 0629 2817
DEVON
Crystal Electronics Ltd
Torquay, Tel: 0803 22699
EXETER
Peter Scott (Exeter) Ltd
Exeter, Tel: 0392 73309
DORSET
South Coast Business M/Cs
Ferndown, Tel: 0202 893040
ESSEX
Prorole Ltd
Westcliff-on-Sea, Tel: 0702 335298
GLOUCESTERSHIRE
Gloucestershire Shop Equipment Ltd
Gloucester, Tel: 0452 36012
HAMPSHIRE
Advanced Business Concepts
New Milton, Tel: 0425 618181
Xitan Systems Ltd
Southampton, Tel: 0703 39890
KENT
Video Services (Bromley) Ltd
Bromley, Tel: 01-460 8833
LANCASHIRE
B & B Computers Ltd
Bolton, Tel: 0202 26644
H.R. Control Systems Ltd
Chorley, Tel: 02572 75234
Sound Service
Burnley, Tel: 0282 38481
Sumita Electronics Ltd
Preston, Tel: 0772 55065
The Micro Chip Shoppe
Blackpool, Tel: 0253 403122

LEICESTERSHIRE
Gilbert Computers
Lubenham, Tel: 0858 65894
Leicester Computer Centre
Leicester, Tel: 0533 556268
Mayes Hi Fi
Leicestershire Tel: Leics 22213
LINCOLNSHIRE
Howes Elect. & Autom. Servs.
Lincoln, Tel: Lincoln 32379
Z. R. Business Consultants
Lincoln, Tel: 0522 680087
LONDON
Bridgewater Accounting
Whetstone, Tel: 01-446 0320
Butel-Comco Ltd
Hendon, Tel: 01-202 0262
Central Calculators Ltd
London EC2, Tel: 01-729 5588
Digital Design & Development
London W1, Tel: 01-387 7388
Euro-Calc Ltd
London WC1, Tel: 01-405 3223
Euro-Calc Ltd
London EC2, Tel: 01-729 4555
Euro-Calc Ltd
London W1, Tel: 01-636 5560
Lion Computer Shops Ltd
London W1, Tel: 01-637 1601
Personal Computers Ltd
London EC2, Tel: 01-626 8121
Scope Ltd
London EC2, Tel: 01-247 8506
Sumlock Bondain Ltd
London EC1, Tel: 01-253 2447
MANCHESTER
Sumlock Electronic Services Ltd
Manchester M3, Tel: 061-834 4233
Sumlock Software Ltd
Manchester M3,
Tel: 061-228 3502

MERSEYSIDE
Microdigital Ltd
Liverpool, Tel: 051-227 2535
Sota Communication Systems
Liverpool L14, Tel: 051-480 5770
NORFOLK
Sumlock Bondain (East Anglia)
Norwich, Tel: 0603 26259
NORTHAMPTONSHIRE
H.B. Computers Ltd
Kettering, Northamptonshire,
Tel: 0536 520910
NORTHERN IRELAND
O & M Systems
Belfast, Tel: 0232 49440
The Microcomputer Centre (N.I.)
Belfast, Tel: Belfast 682277
NOTTINGHAMSHIRE
Keen Computers Ltd
Nottingham, Tel: 0602 583245
Mansfield Business M/C Ltd
Mansfield, Tel: 0623 26610
OXFORDSHIRE
Oxford Computer Store
Oxford, Tel: 0865 45172
REPUBLIC OF IRELAND
O'Connor Computers Ltd
Galway, Tel: 0009 61173
Tomorrows World Ltd
Dublin 2, Tel: 0001 776861
SALOP
Computer Corner
Shrewsbury, Tel: 0743 55166
SCOTLAND
A & G Knight
Aberdeen, Tel: 0224 630526
Business and Electronics M/Cs
Edinburgh, Tel: 031-226 5454

Micro Centre
Edinburgh, Tel: 031-556 7354
Microforth
Dunfermline, Tel: 0383 34954
Moray Instruments Ltd
Elgin, Tel: 0343 3747
Pointer Business Equip Ltd
Glasgow, Tel: 041-332 3621
Robox Data Systems Ltd
Glasgow, Tel: 041-221 5401
Tyseal Computers Ltd
Aberdeen, Tel: 0224 573111
SOMERSET
Norsett Office Supplies Ltd
Cheddar, Tel: 0934 742184
SOUTH HUMBERSIDE
Silicon Chip Centre
Grimsby, Tel: 0472 45353
SOUTH WALES
City Radio
Cardiff, Tel: 0222 28169
STAFFORDSHIRE
W.B. Computer Services
Cannock, Tel: 0543 75555
SUFFOLK
C. J. R. Microtek Co. Ltd
Ipswich, Tel: 0473 50152
SURREY
Petalect Electronic Services
Woking, Tel: 04862 69032
R.M.B. Ltd
Croydon, Tel: 01-684 1134
Saradan Electronic Services
Wallingford, Tel: 01-669 9483
T & V Johnson (Microcomputers)
Camberley, Tel: 0276 20446

SUSSEX
Gamer
Brighton, Tel: 0273 698424
Jax Rest Ltd.,
Brighton, Tel: 0273 687667
M & H Office Equipment
Brighton, Tel: 0273 697231
TYNE & WEAR
P.M.S. Ltd
Sunderland, Tel: 0783 480009
WALES
Limrose Electronics Ltd
Wrexham, Tel: 097 883 5555
Morrison Computer Centre
Swansea, Tel: 0792 795817
Sigma Systems Ltd
Cardiff, Tel: 0222 21515
WARWICKSHIRE
Business & Leisure Microcomputers
Kenilworth, Tel: 0926 512127
WORCESTERSHIRE
Capricorn Computer Systems
Worcester, Tel: 0905 21541
YORKSHIRE
Bits & P.C.s
Wetherby, Tel: 0937 63744
Datron Micro-Centre Ltd
Sheffield, Tel: 0742 585490
Huddersfield Computer Centre
Huddersfield, Tel: 0484 20774
Necocos (D.P.) Ltd
Darlington, Tel: 0325 69540
Quadraphenia Ltd
Sheffield, Tel: 0742 77824
Ram Computer Services Ltd
Bradford, Tel: 0274 391166

Calisto Computers Ltd.

SPECIALISTS IN MICROCOMPUTERS AND SOFTWARE
119 JOHN BRIGHT STREET, BIRMINGHAM B1 1BE
Telephone: 021-632 6458

Our complete package offers you:

- Free initial discussion and advice
- Software packages
- Supply and Installation
- Leasing and Financing Terms
- Maintenance Contracts
- Full After Sales Service

Apple

We offer a full range of equipment from the "Home/Hobbyist" type to the professional Business System. Ask about our "Starter packs". Prices from £700.00-£5000.00.

Video Genie

Calisto Computers announce we are now stockists for the Video Genie Computer System, from 16K to 48K, Disk drives, Printers etc. etc. (Simdmd) the Video Genie is very like the TRS-80. The "Instant Software" programs are virtually identical. Prices from £380.00 to £3500.00.

Delta Systems

A range of Z80 based Micro-computers starting at 64k with 1Meg of 8" Floppy Disk Store, expanding to 512k with 34Meg of Hard Disk Store and Tape Back-up. Prices from £2500-10500.00.

LOBO'S NEW LDOS PUTS MUSCLE IN YOUR TRS-80*

LOBO DRIVES' new LDOS* Disk Operating System is loaded with new outstanding features that will enable you to realize the full power and potential of your TRS-80*. With LDOS, you can support up to eight drives (5" and 8" drives, double-sided drives, double-density drives, 80 track drives), including the new 8" and 5" Winchester fixed disk drives, in any combination.

Other LDOS muscle building features include:
ISAN accessing techniques; — keyboard typeahead; — Dated files; Graphic string packer; — Marked files; — File transfer by class; Built-in lowercase display drivers; — Non-breakable AUTO and DO commands; and many, many more.

LDOS is the perfect operating system to use with your expansion interfaces and disk subsystems.

Special introductory offer: **£99.00 only.**

*TRS-80 is a registered trademark of Radio Shack, a Tandy Company.

Approved Business Dealers for:

Apple II Plus Delta Systems
Video Genie Onyx Systems
As fully authorised Dealers for all the above equipment and as experienced computer professionals, we are the best people to assist you in choosing your computer system.

Onyx Systems

The C8000 series are a range of powerful small business computers from Onyx Systems. This state-of-the-art computer system combines high speed processors, memory, Winchester disk and cartridge tape drive in one efficient, compact package.

Industry-compatible versions of BASIC, COBOL, PASCAL and FORTRAN are available on several operating systems (eg. CP/M), along with communications software, wordprocessing and business application packages.

The C8000 series offers more features, better performance, higher quality and greater reliability than any other unit for the price. Prices from £6500-£15000.00.

We also supply a full range of printers both dot matrix and daisywheel, connection cables and also media (diskettes and disks), stationery (listing paper), ribbons etc. etc.

Contact us for all your requirements, write or telephone for full details and price lists.

**Instant Software™
NOW AVAILABLE
IN UK!!**

**SOLE UK
DISTRIBUTORS!!**

**DEALER ENQUIRIES
INVITED**

THIS MONTH'S SPECIAL OFFER
TELE VIDEO 912C TERMINAL
£485.00 + VAT
ANY QUANTITY

TRS LEVEL II

GAMES — Cassette

- ☐ Air Mail Pilot £8.50
- ☐ Ball Turret Gunner £8.50
- ☐ Battleground £8.50
- ☐ Cosmic Patrol £12.50
- ☐ Dare Devil £8.50
- ☐ Dynamic Device £16.50
- ☐ Drivers £8.50
- ☐ Flight Path £8.50
- ☐ Invaders £8.50
- ☐ Investors Paradise £8.50
- ☐ Jet Fighter Pilot £12.50
- ☐ Night Flight £8.50
- ☐ Othello £8.50
- ☐ Romrom Patrol/Tie £8.50
- ☐ Fighter £8.50
- ☐ Kingdom Capture £6.50
- ☐ Klingon Capture £6.50
- ☐ Space Trek IV £6.50
- ☐ Skirmish 80 £8.50
- ☐ Winners Delight £8.50
- ☐ Your Cribbage and Checkers Partner £8.50

SCOT ADAMS

ADVENTURE

- ☐ Adventure Land £12.50
- ☐ Kid Venture £12.50

- ☐ Galactic Empire £12.50
- ☐ Ghost Train £12.50
- ☐ Mission Impossible £12.50
- ☐ Mystery Fun House £12.50
- ☐ Pirates Adventure £12.50
- ☐ Pyramid of Doom £12.50
- ☐ Slag £12.50
- ☐ Star Trek 3.5 £12.50
- ☐ Strange Odyssey £12.50
- ☐ The Count £12.50
- ☐ Voodoo Castle £12.50
- ☐ IQ Test £8.50
- ☐ Teacher £8.50
- ☐ Vocabulary Builder £8.50
- ☐ Video Speed-Reading Trainer £8.50
- ☐ Word Watch £8.50
- ☐ BPA Basic Programming £12.50
- ☐ TRS80 Utility £8.50
- ☐ TLDIS 16K, 32K, 48K £12.50
- ☐ The Disassembler 16K, 32K, 48K £8.50

Misc.

- ☐ Demo II £6.50
- ☐ TRS80 Tests £8.50
- ☐ IRV £20.50

Home (Personnel) Use

- ☐ Body Buddy £8.50
- ☐ Energy Audit £40.50
- ☐ Personal Bill Paying £6.50

Business

- ☐ Executive Expense Report Generator £8.50

- ☐ Oracle 80 £61.50
- ☐ Sales Analysis £20.50
- ☐ Terminal 80 £20.50
- ☐ The Wordslinger £24.50

TRS80 Disks Utilities

- ☐ Disk Editor £33.00
- ☐ Disk Scope £16.50
- ☐ DLDIS £16.50
- ☐ IRV £24.50
- ☐ Oracle 80 £81.50

Business Galactic Software Ltd

- ☐ Mail list (Model 1 version) £81.50
- ☐ Mail list (Model 2 version) £162.50

Games Scot Adams

Adventure International

- ☐ Adventureland/Pirate's Adventure/Mission Impossible Adventure (3 pack) £33.00
- ☐ Galactic Empire £33.00
- ☐ Galactic Trilogy £33.00
- ☐ Local Call for Death £16.50
- ☐ Mystery Fun House/Pyramid of Doom/Ghost Town (3 pack) £32.50
- ☐ Six Micro Stories £12.50
- ☐ Star Trek 3.5 £16.50
- ☐ Two Heads of the Coin £16.50
- ☐ Voodoo Castle/The Count/Strange Odyssey £32.50

Utility

- ☐ Pet Utility 1 £8.50

TRS80 Level I & II

Education

- ☐ Grade Book £8.50
- ☐ Ham Package 1 £6.50
- ☐ Electronics 1 £6.50
- ☐ Typing Teacher £8.50

Games

Air Flight Simulation

- ☐ Chessmate 80 £8.50
- ☐ Oil Tycoon £16.50
- ☐ Space Trek II £6.50
- ☐ Santa Poravia/Fiumaccio £6.50

Apple Disks Games

- ☐ Air Flight Simulation £16.50
- ☐ Appie Fun £16.50
- ☐ Golf £6.50
- ☐ Mimic £6.50
- ☐ Oil Tycoon £6.50
- ☐ Paddle Fun £16.50
- ☐ Santa Poravia and Fiumaccio £8.50
- ☐ Sahara Warriors £6.50
- ☐ Space Wars £6.50
- ☐ Super Shooters £8.50
- ☐ Sky Bombers II £16.50

Scot Adams Adventure International

- ☐ Adventure/Pirates Adventure/Mission Impossible Adventure (3 pack) £33.00
- ☐ Asteroid £16.50
- ☐ Mystery Fun House/Pyramid of Doom/

Voodoo Castle/The Count/Strange Odyssey (3 pack)

- ☐ Ghost Town (3 pack) £33.00

Education

- ☐ Math Fun £16.50
- ☐ Math Tutor 1 £6.50
- ☐ Math Tutor II £6.50

Home (Personal) Use

- ☐ Solar (Energy) Home £33.00

Business

- ☐ Accountants Assistant £6.50
- ☐ Finance and Investment £16.50

PET Education

- ☐ Ham Package 1 £6.50
- ☐ Electrical Engineer's Assistant £8.50

Games

- ☐ Trek X £6.50
- ☐ Dungeon of Death £6.50
- ☐ Santa Poravia and Fiumaccio £8.50

Instant Software Support System

Instant Software offers a special support and reporting system to enable the users of our software to get the very best support and advice on how to gain the maximum benefit from our products. Enquiries will be actioned promptly to provide a first class service.

*TRS-80 trademark of Tandy Corp. CP/M trademark of Digital Res.

CBasic trademark of Compiler Systems. Apple trademark of Apple Inc.

E&OE

Please use this page as an order form. Tick program required

Name

Address

Tel

Cheque/PO No

All prices include VAT @ 15%, packing & return postage to UK addresses.

Send 50p for descriptive Catalogue.

Dear Computer Dealer, We may well have obsoleted your present micro computer dealership.

If your present micro computer

1. Does not carry a seven year maintenance guarantee.
2. Is not supported by a British manufacturer.
3. Does not offer your users a growth capability.
4. Does not offer a minimum interruption plan during breakdown.
5. Does not start from around £1700 offering all the above facilities

then you could well be dealing with the wrong micro.

We are looking for professional distributors of our latest micro computer system — the Prince.

Your micro checklist

- **Keep up with technology.**
Digico Computers have enabled their users to keep pace with technology since 1966.
- **Provides for growth**
By linking you to powerful mini systems and permit you to develop a real big system capability.
- **Maintenance for seven years.**
Offering a **seven year** maintenance guarantee* the Digico Prince provides the 'coming of age' seal to the micro industry.
- **Backed in Britain.**
Digico Computers have been in the business of computer hardware design, manufacture and maintenance for over fifteen years. With factories in Leeds and Stevenage, the Prince is fully supported in the United Kingdom.
- **Rentals for low cost items.**
Including maintenance, rentals start from way under £20 per week.
- **Minimum Interruption Plan (MIP)**
If your Prince goes down, we'll exchange it for a replacement to keep you running — all in the rental price!
- **Starting from around £1,700**
Start with the computer, visual display, diskette storage, add CP/M operating system plus languages and build up from there.
- **Ready made accounting**
No development cost — just buy proven packages covering sales, purchase and nominal ledgers plus stock control, order entry, payroll, word processing and full graphics.
- **Ideal for new Computer users**
Maximise their learning on a minimum investment and then link them up to larger systems when they're fully familiar and ready to grow.

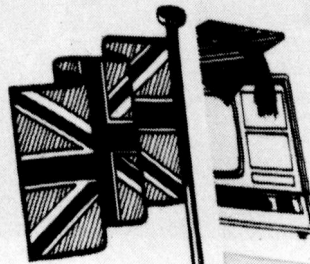
We're looking for the sort of distributor that can sell a real business machine and not leave the user to the mercy of a plaything.

If you want to talk then give me a call now.

George Pitcher

**STARTING
FROM
AROUND
£1,700**

**BACKED
IN
BRITAIN**



**IDEAL
FOR NEW
COMPUTER
USERS**

**DIGICO Computers
MICRO DIVISION**

Arena House
46 Broadway
Letchworth
Herts SG6 3BX
Tel: (04626) 78172

*Providing there is a maintenance contract continuously from new.

COMPUTECH for apple

COMPUTECH for ITT

COMPUTECH SOFTWARE & HARDWARE IS WIDELY ACCLAIMED - WHY?

Companies like Shell UK Oil, Grindlays Bank, W.H. Smith, government departments and hundreds of firms from multinational corporations to sole traders and small businesses have licensed Computech software. Why?

Thirty years experience of business fifteen years experience of computing and dedication to serving the users' interests economically must be major contributions. By the time this advertisement appears about 1000 business software packages will have been installed and supported by us. Note other features which appeal to our customers - no special equipment, all configurations of Apple systems supported, no extra charge for lifetime support, hot-line service, economical use of hardware resources, program code supplied, modifications allowed, full validation, all accountancy requirements satisfied, all data written to disk and recoverable on demand, very simple operation, emulation of traditional manual methods, comprehensive manuals with sample reports, reliable operation, advisory bulletins and free fixing of bugs, (which is fortunately rare). Reduced licence fee for new versions with extra features. As approved dealers of Apple products and actual manufacturers of compatible hardware we combine the knowledge of hardware and software so essential for the application of microcomputers.

COMPUTECH SOFTWARE AND HARDWARE INCLUDES:

Payroll for 350 employees, 100 departments, all pay periods, printed payslips, approved year end documents, very quick and easy to use, **£375**. **Sales, Purchases** and **General Ledgers** **£295** each, detailed statements. **Job Costing** and **Group Consolidation** are amongst many and various applications of the **General Ledger** package, which supports values to totals of one thousand million accurate to a penny! Our **Utilities Disk** available like other packages in 13 sector or 16 sector format, is widely used for reliable, error checking, copying, including single drive, and the renowned **DPATCH** program beloved of programmers for **£20**. We have developed a **Terminal Utilities** package which enables Apple to Apple and Apple to mainframe communications with local processing and storage as well as Apple to host communications from the amazingly low price of **£130**. Our **Graphics Utilities** program for use with the **Microline** and **Epson** families of printers enable the plain paper production on low cost printers of high resolution screen pictures, graphs etc. - free with **Microlines** or **£30** separately. **Keyboard Driver** enables the use of our **Lower Case** adaptor with BASIC programs and **Applewriter Patches** supplied **FREE** with our character generator package (total cost **£50**) is separately available on disk with documents for **£10**. At the same price **CAI** (convert Apple pictures for ITT) makes binary high resolution picture files display properly on the ITT 2020. We sell the famous **Visicalc** for **£125** and have delivered systems using it to do amazing things like production control, shipping accounts and stocks and shares valuations! The versatile **Applewriter** word-processing package at only **£42**, especially employed with our **Lower Case Character Generator** is widely used by people who cannot type to produce word-perfect copy! Experience with Apple systems has led to the design and manufacture of compatible products with enhanced features at very favourable prices to satisfy users' needs. These include the **Diplomat Serial Interface** which has handshaking capability and switchable options (**£80**), the **Diplomat Parallel Interface** which enables the direct use of text and graphics with the **Microline** and **Epson** printers and is a complete 'plug in and go' item with gold-plated edge-connector at **£80** and has optional direct connection for **Centronics 730/737** printers. Our new **Diplomat Communications Card** at **£95** is a sophisticated peripheral especially suitable for Apple to mainframe communications at high speeds in full duplex mode with switch selectable bit rates and other options. The **Lower Case** adaptor is available for Apples (revision 7 and earlier) as well as ITT 2020, complete with diskette software for **£50**. It offers true descenders on screen and the £ sign. We also have an **Optional Character Generator** for the ever popular **Microline M80** at **£15**. This provides £ sign and improved digits and lower case characters with USASCII special symbols. Our price for the **Microline M80**, with graphics, 40, 80 and 132 characters per line, friction, sprocket and teleprinter feed, is only **£345**, amazing for this small, quiet reliable 'look alike' printer. Tractor option is **£40** and **Serial Adaptor** **£80**. The **Microline M82**, bidirectional printer with both parallel and serial input is only **£525**, it can have an optional 2K buffer, while the **Microline M83** full width adjustable tractor 120 cps printer with similar specification is only **£775**. Then for all computer users there is the unique **Micromux** which from **£800** provides up to 16 ports for simultaneous independent serial asynchronous communications! Telephone for data sheets or to arrange a demonstration or for the address of our nearest dealer. Please hurry - the demand for our products has been such that some have been temporarily out of stock. We offer the effective low cost solutions you need. **Prices exclude V.A.T., carriage and packing.**

COMPUTECH SYSTEMS

168, Finchley Road, London NW3 6HP. Tel: 01-794 0202

AGENTS THROUGHOUT THE UK AND OVERSEAS

The Microcomputer with one of the world's biggest names **The ITT 2020**

This is micro computing at its most compact and versatile best. Complete, self-contained – ready to plug in and startlingly simple to operate. With easy typewriter style keyboard, the ITT Floppy Disk Drive Unit with 116k capacity

suitable for continuous business use, for fast, uncomplicated data retrieval – at low cost, to make life easier for almost any type of smaller business or professional situation. To store and display – at the touch of a few keys – anything from address files to a whole year's financial records. All backed by the advanced technology of one of the *biggest* names in electronics today, ITT. With a countrywide advice and after-sales service to match.

ITT

World-wide Technology

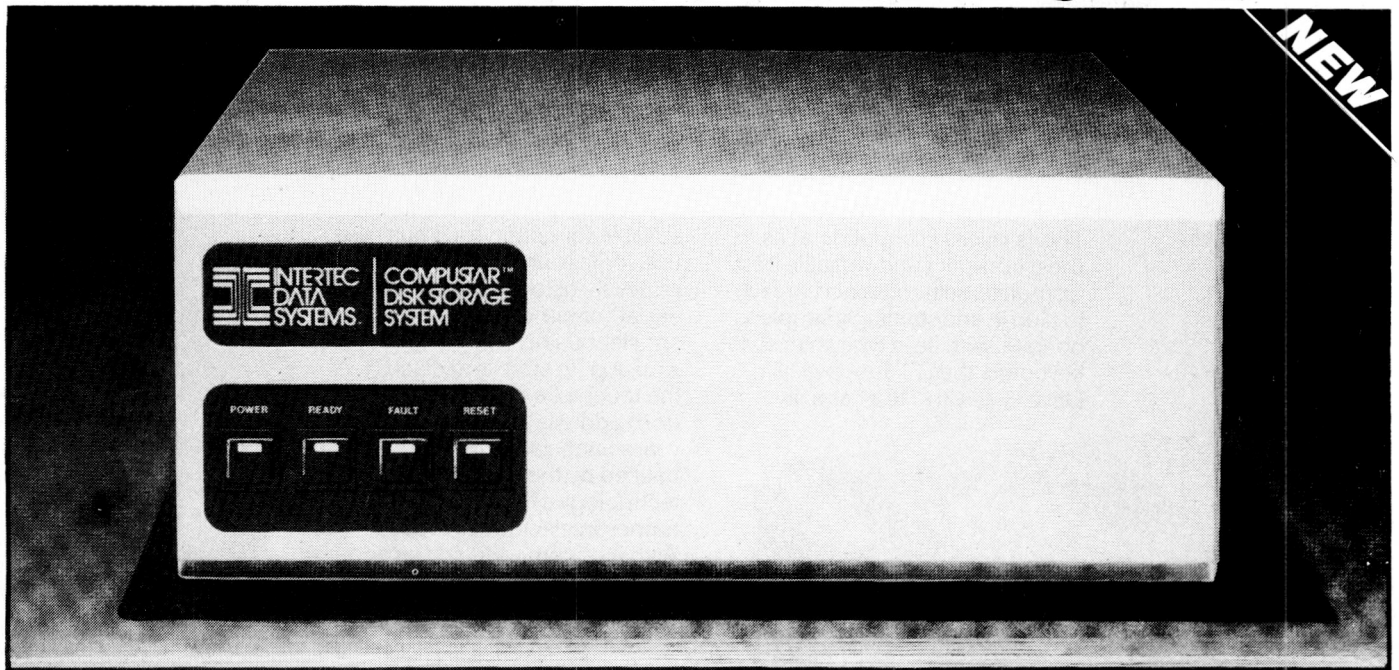
ITT Consumer Products (UK) Ltd.,
Chester Hall Lane, Basildon, Essex.
Tel: Basildon 3040 Ext. 196-198



micronetworks

SOLVE THE STORAGE SHORTAGE

with ten multi-user megabytes



COMPUSTAR™

Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed.

The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

Whether you need an extra 10 megabytes for your SuperBrain or an enormous multi-user network, the CompuStar™ DSS solves your storage shortage problems. Sensibly. And economically. Plus, your investment is protected by a nationwide service.

Providing efficient on-site or depot maintenance.

Get a demonstration of this extraordinary new system today. Call or write:

MICRO NETWORKS LTD.
60 PALL MALL, LONDON
Tel. 01-839 3701

DISK STORAGE SYSTEMS

10 MB Winchester £2,945

- Shugart 8 inch mechanism
- Quiet, table-top operation
- Can be used with CompuStar or SuperBrain Video Terminals

VIDEO PROCESSING UNITS

Model 10 VPU £1,595

- 64K Internal Memory
- Integral CRT, CPU, & Keyboard
- Download programmable

Model 20 VPU £2,195

- 64K Internal Memory
- 350K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 30 VPU £2,595

- 64K Internal Memory
- 750K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 40 VPU £2,895

- 64K Internal Memory
- 1½ MB Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

ALSO

SUPERBRAINS

Model DD £1,845

- 64K RAM Memory
- 320K Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

Model QD £2,195

- 64K RAM Memory
- 670K Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

Model DT £2,595

- 64K RAM Memory
- 1.52 MB Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

FULL RANGE OF SOFTWARE AND PRINTERS ALSO AVAILABLE.

Visit our Showroom at:
60 PALL MALL
and see the Complete Range

DEALERS' ENQUIRIES INVITED

IF YOU DON'T WANT A WORD PROCESSING DOCUMENT
THAT LOOKS LIKE THIS.

YOU NEED A PRINTER THAT PRINTS LIKE THIS.

The more your system can do, the better your terminal should be. That's why, if you're adding text editing capability to your data processing system, you should also think about adding a quality daisywheel terminal to replace the matrix terminal you're using now. And the best-quality terminal you can buy is one by Qume.

A printer for every application.

No matter what application you choose, Qume makes a printer to fit it.

Like our Sprint 5® KSR and RO, which have achieved the reputation for being the easy-to-use leader in letter-perfect terminals. You can have 50 different types to use with it, including APL, scientific symbols and international character sets.

And there's the Sprint 5 Wide-Track™ with RS-232C interface. The first character printer data terminal in the world capable of handling paper up to 28 inches wide. That's a full 264-column printing area. Sprint 5 Wide-Track adds an entirely new dimension to the printed word.

The best backup in the business.

Not only do we make the best printers, but we also provide the best support to back up

what we sell. That means excellent service to the OEM and the end user, and one of the best supplies programs in the business.

So if you're getting ready to upgrade your system, then it's time you upgraded your printer as well. To a Qume.

Ask about the NEW Sprint 7 and 9 models.

For more information
contact your

Qume^[UK]
AUTHORISED
DISTRIBUTOR

ACCESS DATA COMMUNICATIONS LTD.,
228 High Street, Uxbridge, Middlesex. Tel: (0895) 30831.

DAISY TERMINALS LIMITED, Bridge Road,
Haywards Heath, West Sussex. Tel: (0444) 57546.

FACIT, Maidstone Road, Rochester, Kent.
Tel: (0634) 401721.

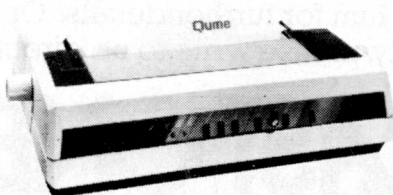
ISG DATA SALES LIMITED, Unit 9, Fairacres Ind. Estate,
Dedworth Road, Windsor, Berkshire. Tel: (07535) 57955.

ROHAN COMPUTERS LIMITED, 52 Coventry Street,
Southam, Warwickshire. Tel: (092681) 4045.

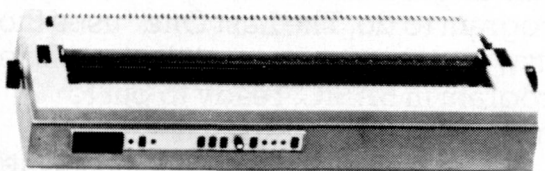
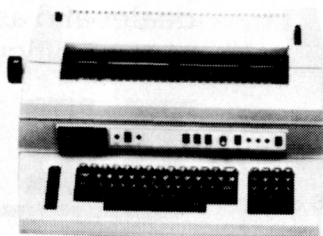
Qume®

Qume (UK) Limited Tel: (0734) 584646. Telex: 849706.

A British Company of ITT



The NEW Sprint 9



ALL THE PROGRAMS YOU'LL EVER NEED. FOR £260^{+VAT}.

Say goodbye to the costs and frustrations associated with writing software: The Last One[®] will be available very soon.

More comprehensive and advanced than anything else in existence, The Last One[®] is a computer program that writes computer programs. Programs that work first time, every time.

By asking you questions in *genuinely* plain English about what you want your program to do, The Last One[®] uses those answers to generate a totally bug-free program in BASIC, ready to put to immediate use.

What's more, with The Last One[®], you can change or modify your programs as often as you wish. Without effort, fuss or any additional cost. So as your requirements change, your programs can too.

In fact, it's the end of programming as you know it.

And if, because of the difficulties and costs of buying, writing and customising software, you've put off purchasing a computer system up to now, you need delay no longer.

The Last One[®] will be available very soon from better computer outlets. To place your order, take this ad into your local dealer and ask him for further details. Or in case of difficulty, please write to us direct.

THE LAST ONE[®]

YOU'LL NEVER NEED BUY ANOTHER PROGRAM.
D.J. 'AI' Systems Ltd., Ilminster, Somerset, TA19 9BQ, England
Telephone: 04605-4117. Telex: 46338 ANYTYR G.



Now teach the next stage with your micro

The pure mathematics operations have been mastered, you've played it at chess, business information has been analysed and printed out.

Now for the next stage: the monitoring and control of other equipment.

These working applications of the microprocessor function are becoming even more important in full computer courses, and Feedback's new range of MICA interfaces and modules provides immediate hands-on experience in

analysing, programming and operating models of real life applications such as traffic control, heating cycle control, diesel generator and many others.

Each module comes complete with manuals suitable for classroom instruction or direct use by the student.

Modules

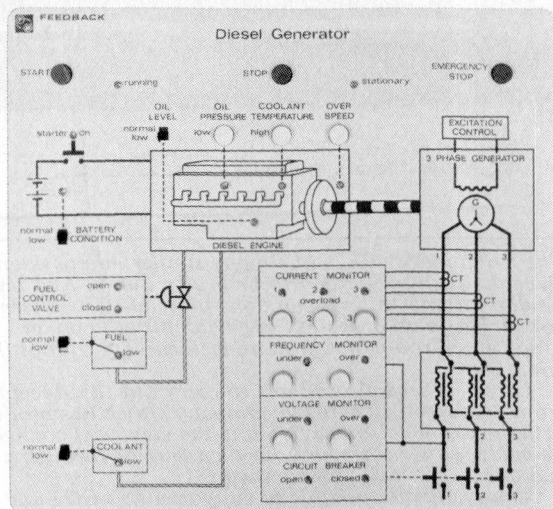
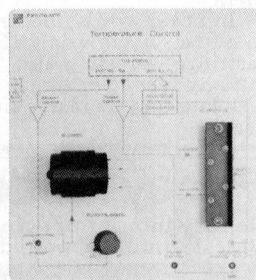
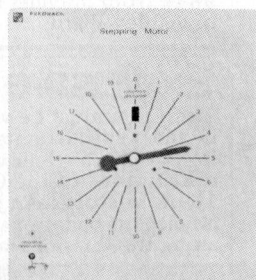
MIC 951 Automatic Washing Machine	£74
MIC 952 Project Board	£65
MIC 954 Stepping Motor	£99
MIC 955 Temperature Control	£132
MIC 957 Traffic Control	£66
MIC 958 Binary Input/Output	£106

Diesel Generator and A/D: D/A Board in development.

Interfaces

MIC 944 PET	£71
MIC 945 AIM	£45
MIC 946 Apple	£55
MIC 947 ABC 80	£107

Interfaces for TRS80 and 380Z in development.
Prices exclusive of VAT



FEEDBACK

Feedback Instruments Limited, Park Road, Crowborough,
Sussex TN6 2QR. Telephone: (08926) 3322. Telex: 95255.

I am very interested in the Feedback MICA series of interface modules. Please send me detailed information.

My present microcomputer is _____

Name _____

Position _____

Organisation _____

Address _____

Telephone No. _____

See the new MICA 950 series at the National Education and Training Exhibition (NEC 2-4 July).

Guy Kewney, editor of Datalink, presents the latest micro news.



Lucas buys Nascom

At last, the Nascom future is assured. It was once Britain's proudest micro-computer company; in the year it has spent waiting for a buyer, it has got at least a year behind the times and its new owner Lucas Logic can't be expected to catch up very quickly. So when the new General Manager John Deane says, 'I believe Nascom's incorporation in our computer portfolio cements Lucas Logic's position at the forefront of this sector of the computer business,' it isn't altogether clear which sector he's talking about.

For the computer users, the takeover means that supplies will continue to flow from the new headquarters in Warwick — until they lose interest in Nascom and want something better. After that, the signs are that Nascom will think hard before investing in a new design aimed pri-

marily at the competitive £200 system market. Instead, the company obviously sees Nascom machines as useful in industrial and commercial applications. It will probably be daunted by the problems of designing something to match up with the Osborne 1 or even the Shelton Sig-Net or the Gemini from John Marshall (the guy who started Nascom in the first place) when they are all available and working in the UK. The reason for being pessimistic is that there is no such things as an established microcomputer company. The market is changing so fast, the technology is moving from one company to another and software is evolving; all these things mean that each year a micro company survives are essentially years of innovation. Big, established companies (like Lucas) aren't good at that.

Blowing Bubbles

The waiting may be over for a really useful bubble memory system, one which can be plugged into a system like a games cartridge but which can have its contents changed, like a floppy disk. Intel, the chip-making company which first experimented with bubbles, has at last announced a product.

It's expensive because it's still tricky to make bubbles. They are, as specialists will know, microscopic magnetic circles, areas of magnetism which show up looking like bubbles on microscope photographs, and the magnetised areas can be moved from one point to the next in a chain of magnetisable molecules. Seen from above the garnet chip surface, as a magnetic field rotates around the chip, a long procession of bubbles marches in orderly single file and, of course,

emerge from the other end in the same sequence they went in. It's a bit like watching the magnetic pulses pass the 'read' head of a disk drive, as the disk spins under it and, not surprisingly, it can be used the same way.

Normally, these bubble chips are sold in their little magnetically sealed packages, with their own circuitry to rotate the field inside the package and store the data in an endless loop.

What Intel has done is to advance the packaging a bit. Several bubble boxes and some control circuitry are put into a little cartridge about the size of a fat paperback, which can be plugged into a control box about the size of a small floppy disk drive. The idea is that a system with a disk drive already fitted can have this drive plugged in instead. At a price of \$2550 for the 'drive' and one cartridge, plus the odd bit of extra interface circuitry and

boxing adding up to another \$1000 or so, it doesn't compare with a disk drive — especially as the cartridges cost \$1915 all on their own (compared with £5 or less for a disk).

And its capacity may be 128 kbytes — about the same as a disk — but it operates at disk speeds, that is, slowly, unlike the games cartridges which have read-only-memory chips and therefore function as fast as the computer's own ROM.

Intel is well aware of these drawbacks, hence its emphasis on a promise that prices will definitely come down. By the third quarter of this year, the price will drop by 26 percent says Intel, and a year later will have dropped by a further 35 percent. However, these are prices to dealers and you have to buy 100 at a time to get them.

In other words, feel free to buy a system using ROM cartridges, or using disk, without any fear of having it go obsolete on you inside five years.

Pricey model

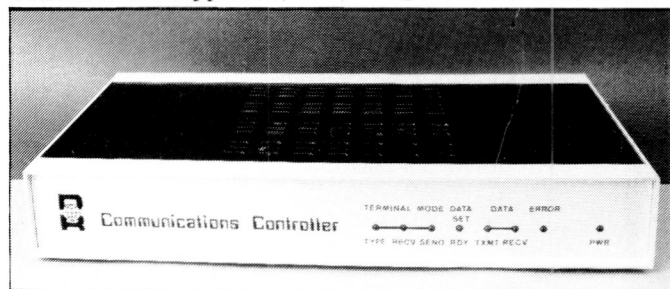
Nobody thought of doing Visicalc until it appeared;

then, suddenly, everybody was producing things that 'do the same modelling job as Visicalc but better.' One of these which was supposedly better is Micromodeller and it has at least outsold Visicalc, in revenue terms, in the UK, so it must work. But since it costs six times as much, it's worth reporting that the new version of Micromodeller which is available for the SuperBrain micro should be seriously compared with the original, Visicalc.

The supplier, Intelligence (UK) Ltd, claims that Micromodeller has 'proved to be just what the micro industry was looking for to persuade senior managers to use personal computers.' The SuperBrain version is the first of several that will run on machines using CP/M as their operating system, says the company. Details on 01-947 9846 from Michael Healy or Ashley Ward.

Exclusive set

Tim Keen must be virtually helpless with laughter as he watches his fellow 'sole distributors' of the Onyx 16-bit microsystem perform an elegant ballet exactly along the lines of the one he



The Commodore PET, like many similar microsystems, is clever enough to pretend to be pretty dumb. And one particularly dumb thing it can do is pretend to be a terminal connected to an orthodox large computer in an air-conditioned room and pretend well enough to fool the large computer.

Latest of several products to carry out this deception is from Davidson-Richards, a company which has produced a little box of electronics to allow the electrical connection to be made, either through your own wire or through a modem and a bit of British Telecom wire.

The system is available to support ICL's CO1 and CO2 protocols and to emulate the performance of ICL equipment with the following model numbers: 7181, 7501, 7502 — and IBM workstations model 3780 and 3270.

Interface box plus software for the PET costs just under £1000; with a working, disk-based PET and printer, a complete work station is around £3000. Details on Derby (0332) 366803.

got involved in around November last year.

And well he might. They are now (count them) five 'exclusive' distributors of the Onyx system.

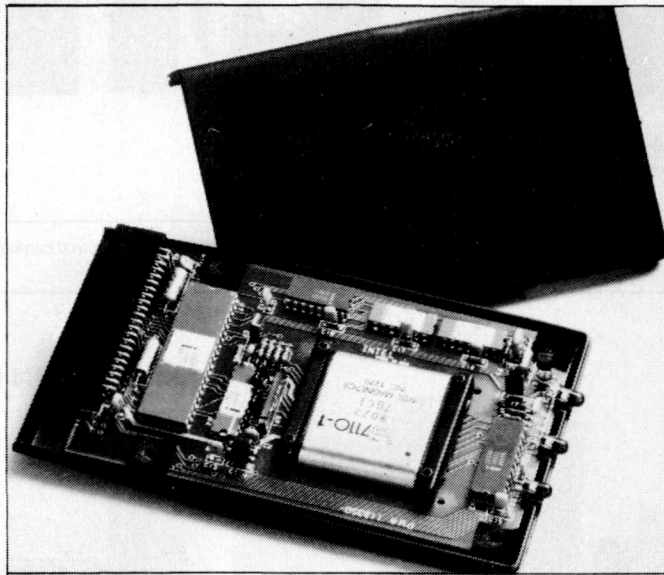
Oh, I suppose it isn't kind to laugh too loud and I'm sure a reasonable 'solution' has been found by now but it really was fun. First, Paul Joyce of Graham Dorian (or is it of Terodec — or both?) was told by Doug Broyles, Onyx president that he was the exclusive UK importer. That was at Compec, when Tim Keen's company, Keen computers, also had Onyx systems for sale on its stand. The somewhat acrimonious debate which followed ended when it was decided that Keen got his through Corvus, an associated company and Paul Joyce got his direct from Onyx. So both were exclusive.

After that, the humour of the business faded and the machine went through a somewhat thin time. There were, in short, problems. As recently as mid-April, one of the dealers (I ain't saying which) could be heard confessing that they weren't selling well. Some say that the problems centred on defects in the power supply, which caused the data storage device, hard disk, to fail in unpredictable ways. Certainly the diagnosis of what was wrong was hard to make and I've heard many different theories — quite usual when a power supply problem is at the root of things, since it can cause a wide variety of symptoms. Then things started picking up; systems started selling in more than ones and twos.

At that point Doug Broyles sent his marketing colleague Steve Gant over to this country. Gant arrived with a couple of pieces of paper, apparently signed in advance by Broyles, with blank spaces naming exclusive distributors.

Gant, who had previously poured some scorn on the claims of Paul Joyce (he said, 'some people have been going around saying that they are pan-Galactic agents for all of Europe') gave the pieces of paper to two new firms, Scan Data and Thame. Thame used to be called Memec and sold Zilog equipment. Scan Data had other interests and a PR agency with some style — the agency announced that 'joint exclusive' distribution rights (whatever that means) had been awarded to the two companies.

This announcement appeared on a press release with Onyx's San Jose address and phone number. It included the somewhat odd suggestion that the appointment 'must inevitably give rise to some speculation over the future of other companies who had franchises'. The release struck Paul Joyce as odd, too.



Intel's Plug-a-bubble cassette — see 'Blowing bubbles'.

Not because of the strange sight of Onyx apparently speculating over its own actions but because he had just been preparing a press release of his own, announcing that Onyx Distribution Inc and Onyx Distribution Ltd had been set up to handle the pan-Galactic marketing of the Onyx. Paul himself, he had been told by Onyx, was to be head of the UK branch of this. So he bought himself a ticket for San Jose. There' an agreement was being formulated at press time, along the lines of 'Paul Joyce of Onyx Distribution is the UK distributor and the others are also purchasers of the original equipment and Doug Broyles didn't know about what Steve Gant was doing but Gant is entitled to appoint agents and they will get their staff (officially) through Joyce.' It'll 'save face' or something.

The real puzzle isn't 'who is the exclusive distributor?' but, rather, 'who would want to have it known that they were the only source?' Somehow the myth persists than an importing and service firm can wear the word 'exclusive' like some kind of badge, conferring instant international importance. The fact that many customers are probably nervous about dealing with an 'exclusive' distributor, with no backup if it goes under, seems to be of little importance compared with the need to boost the managing director's ego.

Cheap or costly

Just how one measures 'user satisfaction per £' is something the UK micro user will have to evaluate carefully. On the face of it, this new commodity either comes pretty pricey, or you can get an awful lot of it wrapped up in

a new British-built micro-system, costing just under £3000.

For the money, LSI Computers will sell you the M Three and the machine is not heavily overpriced, providing you share its makers' pleasure in the display, the keyboard, and the inclusion of two double-density disk drives.

The company is aiming for buyers with slightly more 'office equipment style' tastes than buyers of something like the SuperBrain but with a keener eye for a bargain than buyers of... Well, anything offering two disks, processor and screen for around £4000 upwards (and there are several).

The question isn't really how well it compares with SuperBrain, however, but how it will compare with the Osborne 1 if and when that arrives in this country at under £1000 with a rather better software performance.

The M Three keyboard has 109 keys, which is a lot and, properly programmed, they could be very helpful. The display offers 1920 characters (80 characters on 24

lines), which is better than many micros give you and better than Osborne gives now but fewer than Osborne gives if you count the 'invisible' characters to left, right, above and below the 'window'.

And it doesn't have all Osborne's free software, though it does include CP/M as the operating system.

If LSI Computers had launched this machine in February, it would have made quite a splash. After the Osborne announcement, however, it's hard to grasp the tone of self-satisfaction with which it confesses that it had £1 million worth of DoI money, followed by the claim that 'specification and price have been carefully geared to researched market needs.' When was the research done?

Details on 01-836 2205, which is LSI's publicity agency number.

Quick quote

To quote Steve Jobs of Apple in a comment now much repeated in Silicon Valley where the chips come from: 'We designed Apple II with six guys and it's about to become the most-installed computer of all time. We designed the Apple III with a corporation of 1600 and it still doesn't work.'

ADA

Any computing machine using the 6502 micro, such as Apple, Acorn and PET and with an 8-bit parallel port, can be connected to electronic experiments, processes, automatic test equipment, home environment 'or whatever' through a new interface from Contology.

It's described by its maker as 'low cost', a claim which they infuriatingly fail to back up with figures (always a bad sign) but it does fit in a crate, so don't count on spending less than £100.



LSI's M3 — see 'Cheap or costly?'

nascom

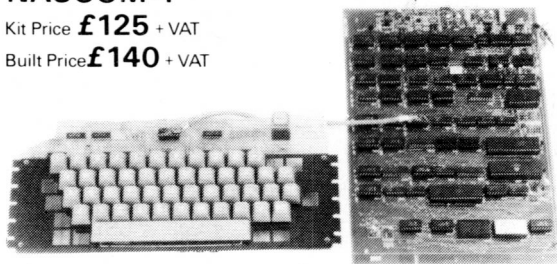
.... Computing for everyone

Nascom products, designed and built in Britain, are now backed by Lucas one of Britain's foremost industrial companies. This is a vindication of the innovative design of the Nascom computer and an assurance of its future.

NASCOM-1

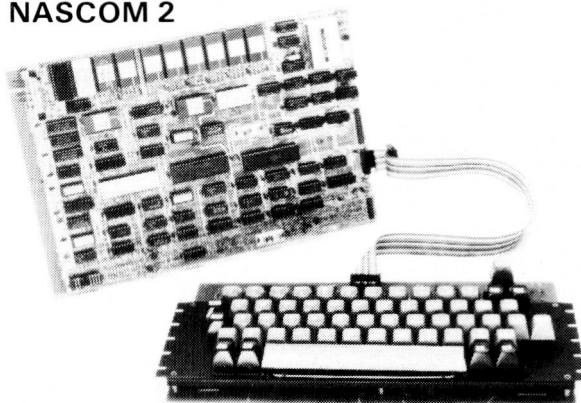
Kit Price **£125** + VAT

Built Price **£140** + VAT



12" x 8" PCB carrying 5L SIMOS packages, 16 1K MOS memory packages and 33 TTL packages. There is on board interface for UHF or unmodulated video and cassette or teletype. The 4K memory block is assigned to the operating system, video display and EPROM option socket, leaving a 1K user RAM complete with keyboard.

NASCOM 2



Kit includes all parts to build CPU board which has resident 8K microsoft BASIC and 2K NAS-SYS 1 monitor for machine code programming. Included with kit is a fully assembled LICON QWERTY SOLID STATE KEYBOARD specially designed to exploit the potential of the NAS-SYS monitor. Other interfaces include video to monitor or domestic TV, Kansas City standard cassette interface (300/1200 baud) or RS232/20mA teletype interface.

In addition to full character generator graphics ROM is provided to give BASIC on board graphics capability. System uses Z80A which gives selectability between 2 or 4 MHz.

Nascom 2 Kit Price **£225** + VAT

Power supply—3 amp. Suitable for powering of basic Nascom 1 or 2 and memory expansion.

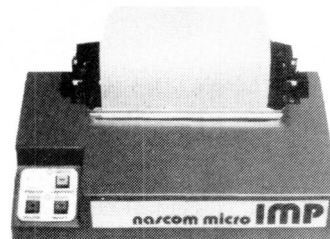
£32.50 + VAT

RAMBOARD

SERIES B ramboard gives user option of 16K DYNAMIC RAM. This board can be arranged in page mode to allow use of up to 4 with NASCOM 2. Boards are fully buffered but PAGE MODE facility is an optional extra. This card can be used at 4MHz without wait state.

16K **£120** + VAT

NASCOM IMP PLAIN PAPER PRINTER



The Nascom IMP (Impact Matrix Printer) features:

- 60 lines per minute ● 80 characters per line ● Bi-directional printing
- 10 line print buffer ● Automatic CR/LF ● 96 characters ASCII set (includes upper/lower case, \$, £) ● Accepts 8 1/2" paper (pressure feed)
- Accepts 9 1/2" paper (tractor feed) ● Tractor/pressure feed ● Baud rate from 110 to 9600 ● External signal for optional synchronisation of baud rate ● Serial RS232 interface.

£325 + VAT

NASCOM FIRMWARE

CPU card can accommodate either 8K of static memory or 8 2708 EPROMS. This allows for inclusion of standard firmware on board. **ASSEMBLER** Version 2.0 of ZEAP (Z80 Editor Assembler Package) offers in 4K features found normally only in far larger programs.

A comprehensive line editor is provided in addition to an assembler operating in standard Z80 mnemonics. Direct assembly to memory allows immediate program execution. ZEAP can take advantage of special features of NAS-SYS, which was itself developed on this assembler. Supplied on tape at **£30.00** plus VAT or in 4 x 2708 EPROMs at **£50.00** plus VAT.

DISASSEMBLER The NAS-DIS 3K disassembler reverses the effect of assemblers such as ZEAP by turning machine code into assembler program, automatically labelling and cross-referencing to produce a complete program listing, saving hours of tedious hand disassembly when program analysis is required. Supplied in 3 x 2708 EPROMs at **£37.50** plus VAT.

DIAGNOSTIC PACKAGE NAS-DEBUG is a 1K addition to NAS-DIS which provides remarkable facilities for error elimination, including a full register display which may be edited by the cursor. An unusual feature is the provision for examination of the program in *assembler* as the machine single-steps through it. A second video page may be assigned to allow work on programs which use the screen. A very powerful assembler-based system for program development could be realised on a NASCOM-2 with appropriate external memory by fitting the 8 ROMs containing ZEAP, NAS-DIS and NAS-DEBUG into the sockets on the computer board. This system would function immediately on switching on, without needing programs to be loaded from tape. Supplied in 4 2708 EPROM at **£15.00** plus VAT and must be operated with NAS-DIS.

NAS-SYS 3. THE NEW OPERATING SYSTEM FOR NASCOM 2.

Supplied in 1 x 2716 EPROM.

NAS-SYS 3 is the latest in the current series of Nascom monitors and includes features such as adjustable keyboard repeat and cursor speed, full interrupt handling and a number of powerful routines and commands making this probably the most comprehensive 2K monitor ever written for a microcomputer. **£40.00** plus VAT.

TO BE INTRODUCED

Programmable graphics colour board
Twin floppy disk unit, double sided,
double density with NASDOS or CPM 2.2

Price

TBA

TBA

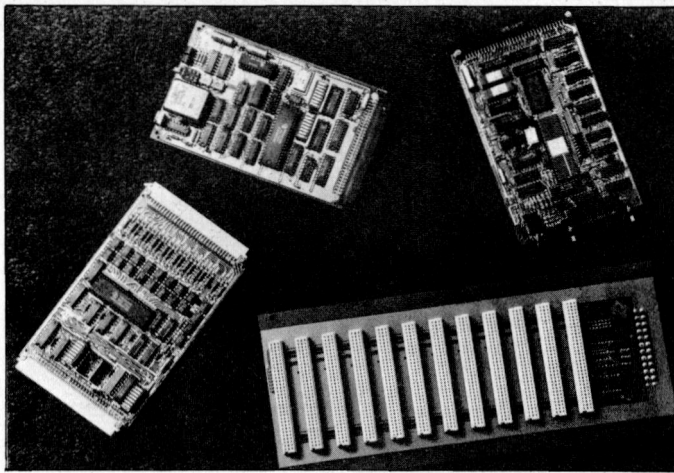
WATCH IT!!

Nascom products fully assembled and packaged in the near future!

Lucas Logic

Nascom Microcomputers
Division of Lucas Logic Limited
Welton Road Wedgnock Industrial Estate Warwick CV34 5PZ
Tel: 0926 497733 Telex: 312333

Please send SAE for list of distributors.



Probably you've admired the amount of aluminium girder and sheet metal inside most multi-board microsystems, necessary to hold each board in steady contact with the 100-pin sockets under it. The less girder, the cheaper; the Eurocard frame should work out cheaper on that basis. Actually, it doesn't because it uses much better contacts; this set of boards is to the new Eurocard DIN 41494 specification, and allows you to build a system using Texas Instruments' 990 microsystem. It's from BA Electronics in Bristol: details on 0454 315824.

The Base unit is a Eurocard box taking up to four add-on cards. These can be either the 6151 unit, which drives relays capable of switching 5 A of mains voltage (eight of them) or the analogue-to-digital and back converter card, the 6152. Details in East Kilbride from W I Macfarlane on 035 52 77153.

Find your roots

The nicest thing about family trees, I've always thought, was the beautifully-scribed calligraphy with all the names in their right place, linked by lines showing blood relations. Nothing, however, could be more frustrating than drawing one of these and then finding that it wasn't quite right. A program to get it all right, to calculate which way the third cousin four times removed links work and also to work out anniversaries, costs \$125. It's called Roots, from Commsoft in Palo Alto, California CA94306; it runs on CP/M machines or on Heath Hdos. Phone (415) 493 2184.

Pascal party

Programmers who are proud of something they have written in the up-and-coming language Pascal can show off a bit in front of their peers. Apparently, a group of programmers who specialise in using the version of Pascal from the University of California at San Diego (UCSD) got together and had a great time in Bristol at the end of January. They just couldn't wait to get together again, so they have arranged a second meeting, in London, on 11-12 September.

Users of UCSD Pascal who

plan to present a paper to the next meeting should send an abstract to the organiser, Cornelia Boldyreff. She's apparently most keen to have people talk about the use of Pascal and the p-system in a commercial application. And if you have a commercial product of your own, hardware or software, they would like to see it demonstrated at the meeting. Details from MacIolm Harper, secretary of the group, at Oxford University Computing Laboratory. The address is at the Programming Research Group, 45 Banbury Road, Oxford OX2 6PE. Abstracts to Cornelia at the Micro Software Unit of the SWURCC, University of Bath, BA2 7AY.

All together now

Last year I met my first big multi-micro system: between two and 100 users all working on the same information but all having a micro to themselves. A company called Jarogate in London (West Norwood) has now appeared with a new multi-user system.

Jarogate is following the lead set by Digital Research, the American software house which has led us from CP/M (four users, but not at the same time) to MP/M (two or more users, cursing each other up and down for fouling up the system) and finally CP/Net and its niece or nephew, CP/NOS.

The Jarogate system looks like a standard Cromemco system with a modern high-capacity hard disk storage system, with an extra box the same size on top to contain from four to seven extra processor/memory boards. At £10,000 it should be able to satisfy those people

who really do want to have four to seven people doing much the same sort of things on much the same sort of data simultaneously and who really don't just want four to seven separate computers. Jarogate is on 01-670 3674.

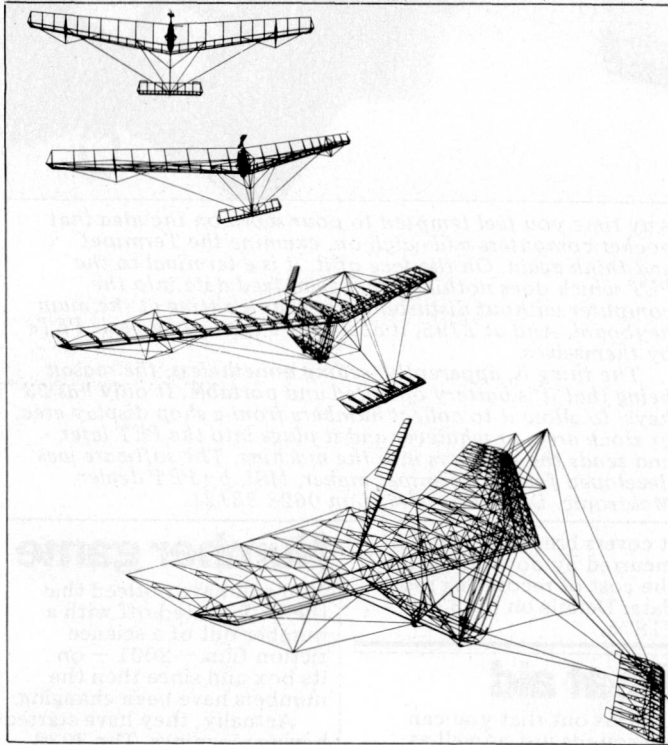
Micro market

Figures on just how big the UK micro market is, may be and will one day become, are hard to find; a £25 good guess is available from Keynote Publications. It describes the area it covers as one 'which has been little affected by the recession,' which must be the understatement of the year. It surveys 11 manufacturers over three years, showing the difference between booming turnover and narrow profits, and suggests that 115,000 will be installed in the UK by the end of the year. I would have put that figure on the number sold at the beginning of the year but maybe Keynote is talking about the more expensive disk-based

system? Still, in a business where guesses are usually the best you can hope for, these figures will be eagerly seized on by many (like Nascom's new owners, I dare say) who are blundering around in the fog. Get it from 23 City Road, London EC1Y 1AA.

Insure your micro

Nobody on this paper would pretend to know a good insurance policy from a bad one but since Stewart Wrightson broking group has bothered to put together a special package for computer users providing cover for people with systems costing less than £5000 (another policy covers machinery worth more than £5000), it seems only polite to tell you about it. It is supposed to be marketed by the guy who sells you the system and he must provide (or arrange) a regular maintenance service under contract. That done,



Drawing pictures like this on a computer screen is a risky business for an amateur — it could easily end up with the screen burning itself out.

The pictures are a 3D plot of the man-powered aircraft (Gossamer Condor) which flew the English Channel, drawn and manipulated by a large and (relatively) expensive Hewlett-Packard HP1000 minicomputer by a large and (relatively) expensive Hewlett-Packard HP1000 minicomputer with a special screen. Keen-eyed readers will note that the lines are not plotted on a standard TV screen (where a regularly scanning line flickers into brilliance when it crosses a line in the picture) but are actually drawn directly, with the computer directing the electron beam. Now there is nothing to say that a clever experimenter could not stick some circuitry into a normal TV screen control to give him software direction of that beam — but could he give fail-safe control? Would he guarantee that if a software bug arose in the user's program, the beam would not jam in one position? Because if it did for more than a couple of seconds, the screen would explode from the excessive local heating. ... better stick to normal raster-screen graphics for the time being.



Any time you feel tempted to pour scorn on the idea that pocket computers will catch on, examine the Termipet and think again. On the face of it, it is a terminal to the PET which does nothing other than feed data into the computer without disturbing whoever is sitting at the main keyboard. And at £795, it costs more than some basic PETs by themselves.

The thing is, apparently, selling nonetheless, the reason being that it is battery operated and portable. It only has 23 keys, to allow it to collect numbers from a shop display area, or stock area, or whatever and it plugs into the PET later and sends the numbers into the machine. The software was developed for the Termipet maker, MSI, by PET dealer Mektronic. Details from MSI on 0628 33121.

it covers breakage and loss incurred by down-time and the cost of recovering lost data. Details on (0533) 21875.

Deaf aid

It turns out that you can see sounds just as well as you can hear them. A group of researchers in Cambridge have put together a video 'game' which replaces the normal process of listening to your own voice to see if the accent is going to please Mummy, with the analogous process of looking at the acoustic wave-form and matching the one from your spoken words with the one shown on the screen. It works, apparently, even if you're entirely deaf. The result is that deaf children, who usually end up speaking in a very rough approximation to the sounds made by those who can hear themselves, can adjust their voices to become perfectly intelligible.

Number game

You will have noticed that the PET started off with a number out of a science fiction film — 2001 — on its box and since then the numbers have been changing.

Actually, they have started having meanings. The 3032 had meaning in the last two digits (signifying the maximum internal memory) and the 8032 even gives you a clue as to the number of characters per line as well — 80.

So the 8096, which was expected to arrive at the PET Show, should have 96 kbytes of memory inside it ... and it does. It needs it, say programmers, to be able to run new software such as Silicon Office. Silicon Office is (I quote from its producer, the inordinately modest Bristol Software Factory) 'undoubtedly the most exciting microcomputer program to be released this year.'

I suppose the 'exciting'

bit is the collection of money from people who buy it. I found it more confusing than exciting from the description: 'it is designed to provide full electronic office facilities in one program'. It is an 'everything' program, in fact, handling word processing, communications over the phone network, accounting and stock control — you name it and it's there. So the program is very long. How well it works only a trial will tell. Details on 0272 314278. All I can say for sure is that it won't run on any smaller PET than the 8096, but it certainly sounds ambitious.

Mighty cassette

Memorial lectures are ostensibly designed to make sure we never forget the person whose name they are given. It doesn't take long, however, before time seals over the gap in our minds left by the person whose memorial it is and we concentrate more on the person who gives the lecture.

Two years after Chris Evans' death, the second Chris Evans Memorial Lecture has attracted the wise old man from *The Guardian*, Peter Large, who will talk about computer technology and printing ('*The Times*, they are a changin'), a lecture I wish I could have told you about before it happened. Large is one of the gems of the computer-watching business, being that rare beast, an older man, sporting grey whiskers and a

benevolent twinkle behind which he hides a marvellous investigative brain.

Had the announcement reached me in time to give you warning I would certainly have done so, even though the lecture is part of a £80 series of lectures at the London Regional Management Centre. The original TV series which Dr Chris Evans himself made to go with his book, is also available now — on video cassette — for £39.95. Distributor is EnterVision, tel 01-353 0186.

Reading lessons

The Personal Computer Palace is a shop. It is a shop worth mentioning because it aims to be the kind of shop 'where people can walk in and play with computers to their hearts' content.' The computers are Apple and Video Genie; other stock includes chess games, educational games, software, books and magazines. It's at 6 Castle Street, Reading, phone 0734 589249 — just follow the hordes of truanting schoolkids (and see *ComputerTown News — Ed*).

Monopoly magic

I worry about 'efficient' estate agent software. Last time I was buying a house, I noticed a strange thing — no matter how carefully I described the type of house I wanted, the agent homed



Resist, at all costs, the temptation to look angrily at that expensive electric typewriter in your office and say 'I can recover the vast amount of money spent on that by converting it into a computer printer, which is what I wanted really.' The cost of converting it starts with the cost of a plug-on set of actuators, continues with the fact that some such kits actually cover the keys, so you can't type any more and doesn't even end with the problem that no electric typewriter was ever designed to take the battering of continuous use and will shake itself to pieces in months. The last straw must be the need to buy this little 'feeder' which feeds the paper into the platen, stopping the weight of continuous stationery from pulling unevenly and slipping on one side. It costs a mere \$150 from San Mateo company McAnn at PO Box 3173, CA 94403, USA, phone (415) 349 1229.

directly in on the price of house I could afford. I could get round that by knowing the area I was moving into and asking if there were any houses in that street and (inevitably) ended up with a house which was bigger than originally planned but actually cost less. From the agent's point of view, however, something like Monopoly, a program from Business Simulations, must look like a winner — it matches houses and also helps in estate management. And anybody who has the chutzpah to call a property management program Monopoly is going to get a mention here just for cheek. Details on 0892 86 3105. It runs on Alpha Micro system.

Tandy speech

There is a software company in California which likes the Tandy speech synthesiser but doesn't think much of the software Tandy has provided for making it talk. So it has set up as BAYSIK SPEECH, selling 5.5 kbytes of machine code which adds a much smoother control program to the machine.

With SAYIT, the voice synthesiser is programmed using English letters. In many cases, normal English spelling will be pronounced correctly but when this causes strange pronunciation, 'soundspelling' is used to force correct speech — for instance Basic sounds better spelled BAYSIK. Contrast this with the coding needed using the Radio Shack (Tandy) software:

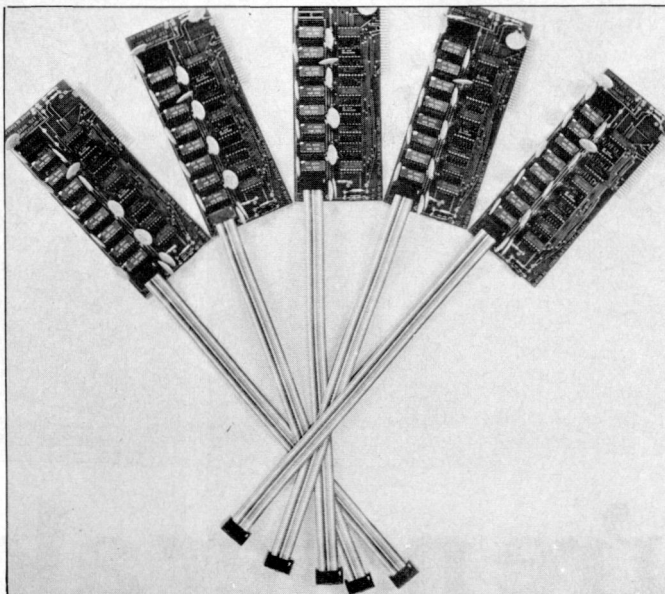
"B"+CHR\$(94)+"S K".
Details from Suite 289,
1259 E1 Camino Real,
Menlo Park, CA 94025.

Gurrow

Just because I don't buy much software shouldn't be taken as an unconditional guarantee that, when I do pay money for code, the code is terrific. I did buy GROW and the code is pretty good; however the documentation is as lousy as all other micro software in this category. For \$35 (£40 in this country through Mike Gurr) what do you get?

A knowledge network links various 'answers' and allows decisions to be built in. Two good examples are a computer-aided instruction sequence and a fantasy game.

Grow does both, quite well. It comes on a disk, for Apple or NorthStar Horizon. You start by going into various 'rooms' and obeying instructions there, like learning a lesson, or walking through a dungeon master's maze. Grow, however, allows you to EXTEND each room. You can have new questions, new answers, new calculations of response, as you see fit.



With Apples selling in the UK at 1700 per month (and rising) the market has reached the point where it becomes worth it for UK manufacturers to make Things To Go Inside. Like cheaper add-on memory, for instance. Cheaper add-on memory is the first product from U-Microcomputers, in the form of a 16 kbyte card costing £130 (£99 in kit form). This will be 'the first of a range of UK manufacture accessories'. It's available through Apple dealers, and details are on 0925 54117.

In a game of dungeons, this causes some confusion for other players, since a room which they visited previously and did certain things quite safely, may suddenly be full of dangers.

For a teacher, it means that you aren't stuck with wrong 'wrong answers' (or 'right answers') for ever. The software can be grown onto new disks, too, using the Gardener package, so that you can set up new networks using the operating software available on the master disk.

Its potential, Mike told me, is immense, and I'm sure he's right, but I wish he could get a better deal with Computer Systems Design Group of 3632 Governor Drive, San Diego CA 91212, (415) 856 1954, because I rather resent the £40.

Big Swede

Swedish users have bought nearly as many ABC 80 micros from Sattco as the British have bought Nascoms — and the Sattco machine is much more expensive, so clearly it has something. Sattco has accordingly followed it up with a big brother — the ABC800 — with a higher class display, the option of a full colour display and a high resolution (240 by 240 dots) display for graphics. It also has a bigger Basic interpreter and can be expanded beyond the normal restriction of 64 kbytes of memory of the Z80 micro. The company promises that all software from the old machine will run on the new.

Details from the UK agent, Datormark, on Weybridge (0932) 44896.

Card collection

The beauty of the S100 system of computer cards is that you don't have to buy someone else's design; you can go through the catalogues, picking a processor card here, a memory card there, an I/O card, a speech synthesiser and so on and so on. You put them all together, and they turn out to run at different speeds, to use line 27 for different purposes and to screw themselves up solid. This explains why Sintrom has produced a box and a series of Periflex 2 cards to go inside. Details on (0734) 85464, to establish that they are all compatible with each other.

Telex link-up

People with good word processing software are normally forced to return to the Stone Age every time they use the British Telecom Telex network, with no control over the input, so a software package to link the two should have powerful appeal.

The Word Magic package has now been linked to Telex by Small Information Systems Company and to the mix, SISC has added a computer monitoring feature: the machine will, if it has enough data storage, send and receive telexes after hours with nobody in attendance. To do this, it

does require a 10 megabyte hard disk, and the whole package is costly, at £9,000 including a good printer and all software. Details on 01-920 0315.

DoI Broadside

There is absolutely no earthly way that government departments can support British microcomputers by insisting that only British micros are used in their offices. Like it or not, it is stuck with the fact that certain American machines, like the Apple, are standards in themselves.

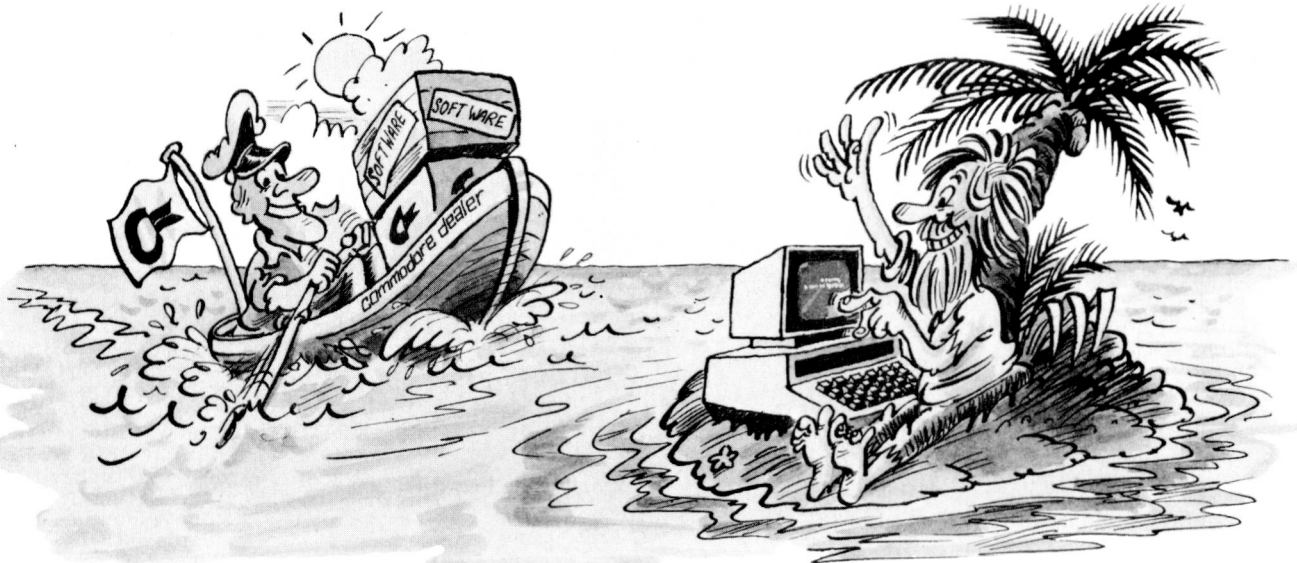
Where British manufacturers feel that the Department of Industry has gone too far is in excluding perfectly good British micros which it already has several copies of scattered around the country. David Broad builds a microsystem called the Communicator which is now virtually debugged and several of which he has sold to Government departments and local authorities. Suddenly, this machine is 'not approved' by the DoI.

Neither are several other machines which are known to be reliable, widely available, and widely used.

One can sympathise with the DoI in principle: the idea of having a few, easily identified machines approved means that servicing them is a problem of known dimensions. You only have to train your engineers to cover the ones in the list and you can buy software in bulk. But, of course, it doesn't work quite like that. For a start, it's easier to guarantee that CP/M software will run on a given CP/M machine than PET software will run on a given PET.

David Broad takes the diplomatic stance of saying that it's all his fault (and that of his fellow British manufacturers) for being 'too low profile.' It's nice of him to be tactful and it may do him some good, too, but it isn't altogether the truth to blame 'low profile marketing' for the fact that the DoI's Central Computing and Telecommunications Authority deliberately advertised on a minuscule scale and with a misleading turn of phrase, with what I know, from inside sources, to have been the overt intention of not attracting too many people. The work of sorting them out, you know — quite frightful.

Broad's group aims to 'widen the Computer in Schools scheme and to extend it to many parallel application fields that will be vital in the regeneration of economic activity.' He also thinks that as well as a computer in every school, we should be aiming for a computer in every business.



You're never alone with a Commodore PET

If you buy just any make of microcomputer you could find yourself on your own. And that's serious. Because without first class software and support, all you're left with is a box of wires.

On the other hand, when you buy Europe's No.1 microcomputer, the Commodore PET, you have access to the largest and finest range of software in the UK today; the most experienced dealer network; 24 hour field maintenance service; plus our very own training courses and user's club – all to ensure that you get the best from your system.

LONDON AREA

Adda Computers Ltd.
W13, 01-579 5845
Advanced Management Systems,
EC2, 01-638 9319
C.S.S. (Business Equipment)
Ltd, E8, 01-254 9293
Centralex – London Ltd,
SE13, 01-318 4213
Computer Sales & Software
Centre Ltd,
ILFORD, 01-554 3344
Cream Computer Shop,
HARROW, 01-863 0833
Da Vinci Computer Shop,
EDGWARE, 01-952 0526
Henderson Bennett,
SE25, 01-654 5609
Home and Business Computers,
E12, 01-472 5107
L & J Computers,
NW9, 01-204 7525
Logic Box Ltd,
SW1, 01-222 1122
Merchant Systems Ltd,
EC4, 01-353 1464
Micro Computer Centre,
SW14, 01-878 7044
Micro-Facilities Ltd,
HAMPTON HILL, 01-979 4546
Sumlock Bondain Ltd,
EC1, 01-250 0505
Sumlock Bondain Ltd,
EC4, 01-626 0487

HOME COUNTIES

Millhouse Designs Ltd,
ALTON, 84517
H.S.V. Ltd,
BASINGSTOKE, 62444
MMS Ltd,
BEDFORD, 40601
D.D.M. Direct Data Marketing
Ltd, BRENTWOOD, 214168
Amplicon Micro Systems Ltd,
BRIGHTON, 562163
T & V Johnson (Microcomputers
Etc) Ltd, CAMBERLEY, 20446
Cambridge Computer Store,
CAMBRIDGE, 65334
Wego Computers Ltd,
CATERHAM, 49235
Dataview Ltd,
COLCHESTER, 78811
Amplicon Micro Systems Ltd,
CRAWLEY, 26493

S.M.G. Microcomputers,
GRAVESEND, 55813
South East Computers,
HASTINGS, 426844
Bromwall Data Services Ltd,
HATFIELD, 60980
Alpha Business Systems,
HERTFORD, 57425
Commonsense Business Systems
Ltd, HIGH WYCOMBE, 40116
Kingsley Computers Ltd,
HIGH WYCOMBE, 27342
Brent Computer Systems,
KINGS LANGLEY, 65056
Computopia Ltd,
LEIGHTON BUZZARD, 376600
South East Computers Ltd,
MAIDSTONE, 681263
J.R. Ward Computers Ltd,
MILTON KEYNES, 562850
Sumlock Bondain (East Anglia)
Ltd, NORWICH, 26259
T & V Johnson (Microcomputers
Etc) Ltd, OXFORD, 721461
C.S.E. (Computers),
READING, 61492
Slough Microshop,
SLOUGH, 72470
Business Electronics,
SOUTHAMPTON, 738248
H.S.V. Ltd,
SOUTHAMPTON, 22131
Super-Vision,
SOUTHAMPTON, 774023
Syntec Systems Ltd,
SOUTHAMPTON, 38868
Stuart R Dean Ltd,
SOUTHEND-ON-SEA, 62707
The Computer Room,
TUNBRIDGE WELLS, 41644
Orchard Computer Services,
WALLINGFORD, 35529
Photo Acoustics Ltd,
WATFORD, 40698
Microchips,
WINCHESTER 68085
P.P.M. Ltd,
WOKING, 80111
Petalect Electronic Services
Ltd, WOKING, 69032
Oxford Computer Systems,
WOODSTOCK, 812838

MIDLANDS & S. HUMBERSIDE

C.B.S. Consultants,
BIRMINGHAM, 772 8181
Computer Services Midlands
Ltd, BIRMINGHAM, 382 4171
Marchant Business Systems Ltd,
BIRMINGHAM, 706 8232
Micro Associates,
BIRMINGHAM, 328 4574
Peach Data Services Ltd,
BURTON-ON-TRENT, 44968
Jordane Associates Ltd,
COVENTRY, 664400
Davidson-Richards Ltd,
DERBY, 366803
Allen Computers,
GRIMSBY, 40568
Caddis Computer Systems Ltd,
HINCKLEY, 613544
Machsize Ltd,
LEAMINGTON SPA, 312542
Arden Data Processing,
LEICESTER, 22255
Roger Clark Business Systems
Ltd, LEICESTER, 20455
Lowe Electronics,
MATLOCK, 2817
A.J.R. Office Equipment Services
Ltd, NOTTINGHAM, 206647
Betos (Systems) Ltd,
NOTTINGHAM, 48108
PEG Associates (Computer
Systems Ltd), RUGBY, 65756
Walters Computer Systems Ltd,
STOURBRIDGE, 70811
System Micros Ltd,
TELFORD, 460214

YORK & N. HUMBERSIDE

Ackroyd Typewriter & Adding
Machine Co. Ltd,
BRADFORD, 31835
Microprocessor Services,
HULL, 23146
Holdene Ltd, LEEDS, 459459
South Midlands Communications
Ltd, LEEDS, 782326
Yorkshire Electronics Services
Ltd, MORLEY, 522181
Computer Centre (Sheffield) Ltd,
SHEFFIELD, 53519
Hallam Computer Systems,
SHEFFIELD, 663125
Holbrook Business Systems Ltd,
SHEFFIELD, 484466

But how can Commodore offer so much? Well, we've been in the high technology business for over 20 years, whereas many of our competitors have just started out. We even manufacture the silicon chips for other microcomputers. This enables us to keep our costs to you down, so you can buy a self-contained PET for £450, or a complete business system from as little as £2,000 (+ VAT).

Of course, you could buy a box of wires for about the same price. But all you'll get from our dealers is sympathy.

NORTH EAST

Currie & Maughan,
GATESHEAD, 774540
Elfton Ltd,
HARTLEPOOL, 61770
Dyson Instruments,
HETTON, 260452
Fiddes Marketing Ltd,
NEWCASTLE, 815157
Format Micro Centre,
NEWCASTLE 21093
Intex Datalog Ltd,
STOCKTON-ON-TEES, 781193

S. WALES & WEST COUNTRY

Radan Computational Ltd,
BATH, 318483
C.S.S. (Bristol) Ltd,
BRISTOL, 779452
T & V Johnson (Microcomputers
Etc) Ltd, BRISTOL, 422061
Sumlock Tabdown Ltd,
BRISTOL, 276685
Sigma Systems Ltd,
CARDIFF, 34869
Reeves Computers Ltd,
CARMARTHEN, 32441
A.C. Systems,
EXETER, 71718
Milequip Ltd,
GLOUCESTER, 411010

Jeffrey Martin Computer Services
Ltd, NEWQUAY, 2863
Devon Computers,
PAIGNTON, 526303
A.C. Systems,
PLYMOUTH, 260861
J.A.D. Integrated Services,
PLYMOUTH, 62616
Business Electronics,
SOUTHAMPTON, 738248
Computer Supplies (Swansea),
SWANSEA, 290047

NORTH WEST & N. WALES

B & B (Computers) Ltd,
BOLTON, 26644
Tharstern Ltd,
BURNLEY, 38481
Megapalm Ltd,
CARNFORTH, 3801
Catlands Information Systems
Ltd, CHESTER, 46327
Catlands Information Systems
Ltd, WILMSLOW, 527166

LIVERPOOL

Aughton Microsystems Ltd,
LIVERPOOL, 548 7788
Stack Computer Services Ltd,
LIVERPOOL, 933 5511

MANCHESTER AREA

Byte Shop Computerland,
MANCHESTER, 236 4737
Computastore Limited,
MANCHESTER, 832 4761
Cytek (UK) Ltd,
MANCHESTER, 872 4682
Executive Reprographic Ltd,
MANCHESTER, 228 1637
Professional Computer Services
Ltd, OLDHAM, 061-624 4065

SCOTLAND

Gate Microsystems Ltd,
DUNDEE, 28194
Holdene Microsystems Ltd,
EDINBURGH, 668 2727
Gate Microsystems Ltd,
GLASGOW, 221 9372
Robox Ltd, GLASGOW, 8413
Thistle Computers (Macmicro),
INVERNESS, 712774
Ayrshire Office Computers,
KILMARNOCK, 42972
Thistle Computers,
KIRKWALL, 3140

N. IRELAND

N. Ireland Computer Centre,
HOLLYWOOD, 6548

For further information about Commodore services and products, contact your local dealer, or send off this coupon to obtain our free literature pack.

To: Commodore Information Services,
818 Leigh Road, Slough, Berks. SL1 4BD

Name

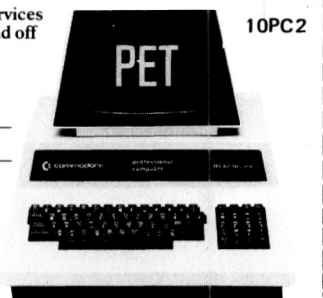
Position

Address

Intended application

 **commodore**

This list covers dealers participating in our advertising.



Cashing in

By now the cash register business will have noticed that people don't want to spend a lot of money on a cash register but are prepared to fork out quite a bit more on a cheap computer. It must annoy them. One cash register maker has decided to cash in on this by selling a cheapish (£3500) micro-system with floppy disk and video display, which is also a cash register. In addition, the firm (Anker Data Systems) has designed its new machine so that it can control several of its older models and it can work in betting shops as well as supermarkets. After all, it is a computer. Details on 01-947 1378.

Apple printers

A printer costing £300 for the Apple has been released by Micro Peripherals of Basingstoke as one of three new printers with a price appeal. The MX 70 gives 80-column print and can copy the Apple's high resolution display dot pattern; the MX 100 costs £600 but gives 136 characters per line and is faster, while the MX 85 will copy any video screen and the price is obviously too frightening to publish, because Micro Peripherals has kept it to itself. It will send print samples for each printer but it seems clear that the one thing these matrix printers can't do is imitate the intensity variances of the graphics screen. Few printers do. Details on (0256) 56468.



People don't often cause a stir in this column unless they've just become bankrupt, or been appointed nineteenth exclusive nervous breakdown to a Japanese anti-trust micro company, but the bespectacled face of Steve Feldman is one which deserves a little flash.

He has joined Alan Wood, one of the more influential movers in the micro business, at Wood's company Digitus. And he is setting himself up as an expert-to-be on networking systems.

He is an old hack in the computing business, having been around for 20 years, and what makes him special isn't his expert knowledge of networks (he readily admits that, so far, he has little), nor the fact that I've asked him to write a regular column for my other paper (DataLink), but his enthusiastic abandonment of the doldrums of old-fashioned computer-room activity for the buzz of the micro world. He has actually done a lot of micro work for his old company, Data Logic, but my honest opinion is that it was all done with the old mainframe/mini hat on. Now he's getting into the retail end of the business and there's an object lesson there for other old hacks, if they care to watch.

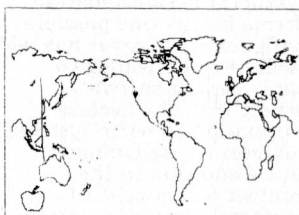
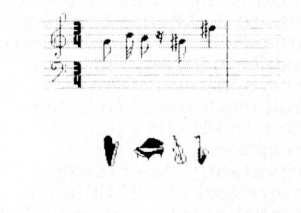
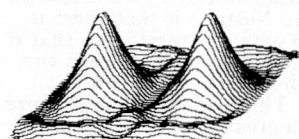
Incidentally, he was one of the founders of that ultra-respectable old-world software house Logica, so his departure from orthodox practices isn't due to ignorance or underachievement. Just recognition of where the wind blows.

Tepid grovel

Trying not to feel too guilty about a tepid welcome I gave to a Guild Sound and Vision training package on video tape, I think I'm going to make myself a small excuse. It has no computer as part of

the video course and the bit of the publicity which suggests (as I did) that using a computer was essential didn't get to my desk.

That's the excuse; I'm pleased to say that GS&V has politely put me right and insists that the course needs a computer.



These fascinating pictures can be drawn on the Apple II screen, using its high resolution graphics and quite a bit of sweat. However, getting them onto paper isn't too easy unless you have the right printer — hence Stack Computer Services' decision to produce a new circuit card, costing £140.

In normal use it behaves as a standard printer controller (Centronics interface) but it also has software built in to interpret and print the contents of Apple's two high-res graphics screens on 'most of the popular matrix printers'. Additional commands allow the user to scale the output, put it to the left, or the right, or the centre of the paper, or to invert the image. Details on 051-933 5511.

Clive's Computer



By TED RICHARDS





YANKEE DOODLES

Tom Williams reports on the American side of the microscene

Ten megabytes on a single side of an 8in floppy disk are certainly going to make a name for Iomega Corporation, 4646 South 1500W, Ogden, Utah 84403. Such an improbable storage capacity on a floppy is made possible by two techniques: an improved high-density oxide formula by 3M Company and a crafty method of making the flexible disk rigid while it is spinning, thus enabling the head to be positioned very close to the disk surface. The head never contacts the disk as in normal floppy systems.

The Alpha 10 disk subsystem accepts floppy disks contained in cartridges. When a cartridge is inserted into the drive, a door in its end is pushed back and opened and the disk is positioned on the drive spindle. Above the disk is a metal plate with a slot in it through which the read/write head has access to the disk. As the disk spins, it tends to force itself against the plate. This is counteracted by air drawn through the drive spindle and out between disk and plate. The head itself is contoured so that the constant airflow caused by the rotational speed assures a stable head-to-disk flying height. The rotational speed is 1500rpm, or half that of a Winchester disk. The air flow also works against contamination because the flow tends to carry particles around the head rather than directly over it. The people at Iomega say they have repeatedly blown smoke into a running drive with no ill effects.

Disks are preformatted with embedded servo information. Formatting consists of 306 tracks of 70 sectors each. Each sector, however, contains two 256-byte data fields so that the controller can be told to act on logical sectors of either 256 or 512 bytes.

'Radio Shack seems to have done it again...'

On the networking front, Radio Shack seems to have done it again. It has announced a number of hardware and software products that

will allow anyone to set up miniature Videotex system. Minimally, a 64k TRS-80 Model II can be used with a modem/multiplexer that will handle up to 16 phone lines simultaneously. The software allows pages of information to be stored on disk as in the Prestel system and will handle user requests for presentation of pages.

For convenient data base updating, another TRS-80 Model II can be used to collect data from Information Providers and to quickly update the other computer without disturbing the users. The addition of a software-controlled switch, called the Network Three, allows additional database computers to be added to the system — each serving up to 16 simultaneous calls — which can also be serviced by the same update computer.

Local networks are also proliferating these days. The Nestar Cluster/One is well known, as are the higher-end networks such as Z-Net and Ethernet. But a relatively low-cost local network scheme which will allow up to 64 small computers of different types to be placed on the same net has just been announced by Corvus Systems, 2029 O'Toole Ave, San Jose, California 95131. Called the Omninet, the network uses a single twisted pair of shielded cables which can be up to 4000ft long and transmit data at a rate of one megabaud.

The key to the Corvus Omninet is the interface card called the Transporter. Different Transporters are being developed to fit into the bus of a large number of popular computers, among them Apple II, S100, TRS-80, Zenith, DEC LSI-11, Altos and more. The Transporters differ only in that part of the circuitry which interfaces them to a given bus scheme. On the side facing the network bus (that simple twisted pair), they are identical. That part of the card consists of a 6801 micro-computer with on-chip ROM and a custom gate array chip. This part of the circuit takes commands from the host CPU, telling it which part of host memory to send data from and to which of the other computers on the net to send it. The transfer is a DMA out of the host's memory and that data is sent in serial form along the line to the other Transporter,

which accepts it in serial form and puts it in its host's memory via DMA.

At present, Omninet can be readily used with Apple IIs in conjunction with Corvus' Constellation hard disk system. The Constellation is a system that lets various computers share the resources of a hard disk. Constellation software arbitrates requests for disk access, maintains files and the like. What the Omninet does is allow a large number of machines to share a single line. The difference between Omninet and a local network like Nestar's is that there is no network master, so that if one machine goes down the others are unaffected.

This also means that there is a great deal of software to be written in order to utilise all the possible ways the transporters could be put together; the Constellation scheme is only one possible configuration. Corvus has said it will be quite willing to supply serious software authors with the necessary information to write systems programs to use Omninet. Future addition to the Omninet will consist of peripheral 'servers' — intelligent interfaces using Transporters and allowing the Net to share expensive equipment such as printers and hard disks. Corvus will also make 'gateways' to other networks, both other Omninet and other types of network such as Ethernet.

All this brings to mind the subject of standards and synergy. There was a time when companies were a great deal more paranoid about maintaining absolute control over the products of their own brainpower than many today seem to be. The classic example, of course, is IBM, who spends untold millions trying to make it impossible to use any equipment with IBM machines than that made and blessed by 'Big Blue' herself.

'This business of networking ...demands compatibility..'

This business of networking, however, demands compatibility in order for

anybody to have any success at it, hence the initial decision of Xerox, Intel and DEC to collaborate on Ethernet — a standard which has yet to become fully defined. On the other side, however, the need for local networks was so great that people simply couldn't wait for a standard to be hammered out in dreary committees. Thus we see an increasing number of companies going ahead and implementing their own local network schemes which may be specific to that implementation on one level, but which are looking forward to a future general standard in which all can participate.

Thus, Zilog is not only implementing Z-Net and trying to make all future products compatible with Ethernet, it is providing information on its own hardware and software products to other manufacturers who wish to make such things as computers and printers easily usable on Z-Net. That way everybody wins. The products are sold to Z-Net users and Z-Net gains in acceptance. And, more importantly, the broader future goal of full Ethernet compatibility is not excluded, even if that means compatibility upward through special gateway devices. We can have networking now and Ethernet later and yet not give up valuable hardware and software investments.

Preserving those investments is becoming a watchword among the more responsible manufacturers. They take a go-slow-but-sure approach and are no longer bedazzled by the latest technological widgets. If a new product means the customer is going to have to scrap years of investment in programming, the chances are he will not be interested in the new goodie. Altos Computers, 2360 Bering Dr, San Jose, CA 95131 has noticed that its customers are quite willing to wait for new developments because Altos has instilled in them the confidence that when the new product does arrive, it will be backward compatible with all the things that the customer is already using. Of such things are great fortunes made.

Are You Making the Most of Your Career in Computing?

For a convenient (and inexpensive) way to keep up . . .

THE COMPUTER BOOK CLUB

Books and Services for the Information Processing World

Why is the Computer Book Club the one source for the best books at the best prices? Here are five good reasons:

- **Editorial Quality** Each month you'll find on offer only the finest books in your field, reviewed and selected by our own team of experts.
- **Big Savings** In addition to getting your choice of three books for £2.00 each plus p&p*, membership will entitle you to keep on saving—up to 25% (sometimes even more) off on all books.
- **No Pressure to Buy** We'll send you the club News monthly, describing our newest offerings, but there is absolutely no need to take any particular book or to take a book each month. All we ask is that you pick at least four books during your first year of membership.
- **Software Services** We'll be contacting our members in the next few months to see if we can be of further service to them in the supplying of software packages. All member needs and responses will be incorporated into our study.
- **Added Advantages** You'll be able to read the club news at your leisure, make your selection from the comfort of home and have the books you select delivered promptly to your door.

Please accept my application and enrol me as a member of The Computer Book Club. Send me the three book choices whose numbers I have indicated below. (Some more expensive books, as shown above, will count as two choices.) You will charge me a total of £6.00 for my introductory books, plus £1.25 toward postage and packing*. If not completely satisfied I may return the books within 10 days, cancel my membership and owe nothing.

As a member my commitment is to buy 4 books in my first year of membership. I do not need to take a book each month. If I want an alternative to the main selection, or no book at all I will tell you so, on the form provided. I am over 18 years of age.

Write the codes for your choices here:

Mr/Mrs/Miss _____
(please print)
Address _____

Postcode _____

Signature _____

SEND NO MONEY NOW Post to The Computer Book Club, Wiley Dist. Centre, Oldlands Way, Bognor Regis, W. Sussex PO22 9SA. Offer limited to one per household. Allow 28 days for delivery. The Computer Book Club is a division of John Wiley & Sons Ltd Reg. no. 641132 England

*OFFER NOT VALID IN U.S. & CANADA

Xitan

South Coast Leaders in Microcomputer Support Application and Service



Xitan – First for Business & Commercial Systems

Xitan's specialised Administrative and Operational Microcomputer Systems provide cost effective computer support for wide ranging business organisations; from low entry level, stand alone systems for the smaller business, to integrated multiuser/multitasking systems to meet the more specific needs of the larger business enterprise.

Xitan – First in Science and Research

Xitan support the more personalised requirements of the scientific and research users universities and colleges, and in government and independent research establishments with comprehensive practical experience embracing hardware, system, and applicational software.

Xitan – First in Industry

Xitan's depth in microcomputer experience is playing an increasing role in the rapidly developing industrial applications for production and process control, and in product and production development operations.

Xitan – First for Service

Xitan's local reputation is founded securely on Service- both in system development- software and hardware support, and service in the field.

XITAN

SYSTEMS

Xitan Systems Ltd 23 Cumberland Place Southampton SO1 2BB Tel: 0703 38740

Cromemco SHARP North Star Horizon comart



NEWS

ComputerTown UK! is a nationwide network of voluntary computer literacy centres. All letters should be addressed to: CTUK!, c/o 14 Rathbone Place, London W1P 1DE.

Fantastic news — this month another six ComputerTowns have started up! Heartiest congratulations to those responsible. Let's have a look and see who they are.

First of all, Alan Waring and David Clark have started ComputerTown Enfield at the Ridge Avenue Library. Keep your eyes peeled for notices in the library or contact Alan at 50 Drayton Gardens, Winchmore Hill, London N21, telephone 01-360 8020. David can be contacted at 14 Haughmond, Woodside Grange Road, Woodside Park, London N12, telephone 01-445 5324. PCW contributor Alan Tootill was one of their first volunteers.

ComputerTown Street (in Somerset) has now started up and it holds meetings every Monday from 6.30 to 9.30 at 19a West End, Street. Tom Graves is the man responsible, aided and abetted by Beaver Systems, Mutek, Norset of Cheddar and Somerset Computers. Sounds like a really nice part of the country to be in if you're a computer freak. Tom's phone number is 0458 45359 and, if that seems familiar, it's because he's a leading light in the Ohio Scientific UK User Group and the man behind Wordsmiths.

Brigitte Gorton wrote from New Addington to say that she'd 'been galvanised' into starting a ComputerTown, New Addington every Thursday afternoon at 3 o'clock. I guess it's being held at the local library but her letter doesn't say. Brigitte can be found at 18 Pirbright Crescent, New Addington, Croydon CR0 0RT.

Gloucester, too, now has its very own ComputerTown. Steve Haynes is the man who started it and it runs in the Hucclecote Community Association's premises. Steve is also starting a users group so if you're interested in either or both then contact Steve at 5 Guinea Street, Kingsholm, Gloucester GL1 3BL. No charge will be made for CTUK! meetings and a nominal fee will be charged for user group activities. In this way the user group can pay for hire costs and use of the HCA's facilities both for itself and for ComputerTown.

We had an interesting letter from Keith Taylor from the finance department of Renold Ltd. Keith has been doing his bit for computer literacy within his company of about 400 employees. He asked if his group could join CTUK! — we don't mind who joins as long as they are genuinely involved in the spreading of computer awareness on a non-commercial basis. Already a number of computer clubs have written to say that they've been running similar schemes for some time now. That's great — there's no need to

call yourselves ComputerTown, it's what is being done that is important. ComputerTown is a handy name which new groups can use and to which existing groups can affiliate themselves if they want to. Renold's offices are at Carter Hydraulic Works, Thornbury, Bradford BD3 8HG. I think a letter would be better than a phone call since that is Keith's business address.

Caversham Park Village near Reading is now the proud owner of a ComputerTown. This one was launched by Pat Colley in the premises of the Caversham Park Village Association. Douglas Milne of Personal Computer Palace in Reading heard about Pat in PCW and turned up with an Apple to help out. Other dealers please note. As long as you don't try to sell your wares, you'd be more than welcome at any ComputerTown. You may even want to start your own — write to me if you need any guidance on setting up.

Last month I went to visit ComputerTown, USA! and the people there are thrilled to bits with all your efforts. CTUSA! shared a stand at the West Coast Faire with People's Computer Company, probably best known for its *Dr Dobbs' Journal*. I've fixed for all new ComputerTowns to receive regular copies of the CTUSA! monthly bulletin. CTUK! will also be exhibiting in September at our very own *Personal Computer World* show. Anyone who wants to help out should get in touch with me very soon, since by the time you read this the show will be less than ten weeks away. As I said last month you'll have to pay (or scrounge) your expenses, we can only provide the stand and its facilities.

I've finally got the ComputerTown records 'computerised' so now I'm working on a comprehensive document to help all would-be ComputerTowns to get off the ground. It includes a draft constitution which can be adopted by any ComputerTown simply by filling in the blanks with appropriate details. I am indebted to that well-known barrister Alistair Kelman for his help with this. Alistair has already told me how to set about things and he will be checking over the final draft to make sure that everything is covered. The document will also give practical help on the actual running of a ComputerTown taken from our collective experiences. If you feel that you have any hints and tips to offer then please send them to us. Don't worry that we may already have covered the same ground; I would far rather receive information twice than miss it altogether.

I said last month that I'd bring more news of ComputerTown Horsham. Well the news is that Andrew Holyer is running the show every Saturday during term time at Forest Boys School in Horsham. In common with most Towns, the first session was very quiet

but word quickly spread and it is now wildly popular. I also promised further information on the Cedar project — Judith Morris runs this from Imperial College Computer Centre, Exhibition Road, London SW7 2BX, telephone 01-589 5111 extension 1160. The project exists 'to encourage teachers to examine the possibilities of educational computing, to recognise its contribution as a solution to some of their problems and to facilitate the development of appropriate educational tools'. The project maintains records of all relevant books and papers as well as details of existing CAL packages. Seminars are organised and demonstrations given. In this column I can only give the briefest of overviews; if you feel you'd like to know more then I'm sure that Judith will be delighted to hear from you.

ComputerTown found its way into a magazine called *Training Action*, and a very nice write-up it was, too. Editor and writer of the article, Leo Jago, described CTUK! as 'the fastest-growing voluntary organisation' and he should know since the magazine is the house journal of the National Council for Voluntary Organisations. They can be found at 26 Bedford Square, London WC1B 3HU, telephone 01-636 6039.

Other people this month who'd like to help or set up ComputerTowns are: Gary Quinn of 52a Guisborough Road, Moorsholm, Saltburn by the Sea, County Cleveland TS12 3JA; David Lee, 184 Hill Lane, Southampton SO1 5DB; Michael Lee, 22 Newlyn Drive, Sale, Cheshire M33 3LE; (what a coincidence — apart from the fact that both these gents are called Lee, one is a physicist and the other a physics teacher!); Mr J B Hawkes, 10 Windmere Close, Aylesbury, Bucks HP21 7HP; R L Saunders, 14 St Nicholas Mount, Hemel Hempstead, Herts HP1 BB, telephone Hemel Hempstead 51910. I'm sure that every one of these people would welcome contact with others who feel they'd like to help.

Finally, we've had letters from people interested in ComputerTown in the following areas: Walton on Thames, Salisbury, Rinteln: BFPO 29, West Malling, London W12, Birmingham B29 6NB and Harrow.

Thank you all once again for this splendid support. If you'd like to help with a ComputerTown then write to me (David) at the main CTUK! address and I'll send you some guidelines or put you on to a nearby ComputerTown. Keep in touch with us as things develop so that we can give your activities publicity through ComputerTown News. Remember, all letters which need a reply should be accompanied with an SAE and please don't try to ring us at PCW because CTUK! is a spare-time project.

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add "not for publication" if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', Personal Computer World, 14 Rathbone Place, London W1P 1DE.

Linsac letter

In his review of *The ZX80 Companion* in April's *PCW*, Peter Turk described the book as 'accurate and detailed' but quoted a price of £10 as 'a bit steep'; in fact, the price has been £7.95 for several months, and it was unfortunate that our advertisement in the same issue also suffered the attention of printers' gremlins, the price being omitted!

For your readers' information, we now supply a 20-page ZX81 supplement with the *Companion*, including programs and tips on the 8k monitor. A large stamped addressed envelope will bring full details of all our ZX80 and ZX81 products. Bob Maunder, Linsac, Middlesbrough

Protection points

With reference to Mr R E Bailey's letter and your comments thereon in your April issue, I should like to make some observations for general consideration.

Firstly, I must point out that the Courts have *not* yet decided if Copyright extends to Software, although if the expected Green Paper on Copyright follows the Whitford recommendations any new Copyright Act may get as a result will probably extend Copyright to Software.

Secondly, Copyright protection covers the *expression* of an idea *not* the idea itself. The explanation of how to produce a game cannot be monopolised through copyright, only the expression of the idea in, say, the software listing. Patent protection is the only way one can protect the 'industrial application' of an idea.

Thirdly, the restricted acts specified by the Copyright Act 1956 which are relevant in this case relate to the reproduction of the work or an adaptation of the work or the making of an adaptation of the work. The onus is on the Copyright owner to show that copying has occurred and it must be remembered that independent creation of a program involving the idea is an infringement of the protected work.

Fourthly, the Copyright Act 1956 includes at Section 2 subsection (6) definitions as to what is an 'adaptation' of a literary work. It is widely assumed that Software will be accommodated under the

term 'literary work', although it may be that flow diagrams will be accommodated under the term 'artistic work'. Included in the list of definitions for 'adaptation' is 'a translation of the work' and it is considered that translation is not to be limited to a different language from the original work. Under these circumstances, it seems clear to me that the mere 'translation' of the original program listing so that a 'new' program is produced which will run on another machine would be held to be an adaptation of the original literary work and is, therefore, a restricted act which if performed without the permission of the Copyright owner would be an infringement of the Copyright in the original work.

Finally, I wonder if I might enquire through your columns if there is any great depth of desire for a legal system which would provide protection for the implementation of ideas in software packages. On this theme it is clear that the Patent system in the UK can be used to protect a *product* when operating in accordance with a program package as long as the product includes an invention which is 'new, involves and inventive step, is capable of industrial application and the grant of a patent for it is not excluded by the Act'. As a matter of interest, although the Patent on such a product does not extend to the program *per se*, Section 60 (2) defines that the supply of an essential element of the invention is an infringement of a patent. I am of the opinion that the supply of the software listing of a program, which when loaded into a suitable hardware arrangement, caused a product to be produced which infringes the claim of a patent, will be held to be the supply of an 'essential element' and will therefore be an infringement of the patent.

R J Hart, Liverpool

Join the ACC

Help us to help yourselves and hundreds of would-be members of clubs and user groups who are being lost to our movement through lack of information about those organisations. The Amateur Computer Club — the first computer club in the world, founded in 1972 — is your own national body. Among our more important services we are building up a

comprehensive database of clubs and user groups. The ALCC has generously passed over the initial data used at its Easter fair and we are allocating 1k per group/club. At least 100 groups are missing and much of the present information is out of date. Will officers therefore provide data in two parts: concise details, contact addresses etc for wide publication; and supporting information about your activities to help us spread news and represent your views nationally.

We have made another breakthrough by obtaining a large club area at the *PCW* show; a lot of groups have already booked free space — but a lot of room is still available.

We will provide full details of the above and other activities such as our two Autumn conferences, or networking and small robots and Micro Mouse, if you contact me (preferably with feedback with other things you expect from your national body):

Vernon Gifford, Planning & Liaison Office, ACC, 11 Selhurst Rd, London SE25 6LH; tel 01-653 3207.

Magic wand

As a dealer supplying the Magic Wand package, we were very pleased to see the review of the system in your May issue. Unfortunately one of the few complaints made by your reviewer, that file sizes are limited by the size of the text buffer, is not in fact a restriction imposed by Magic Wand. The system can handle file sizes of up to the CP/M limit, and the read and write commands displayed in the illustration in your review are used to manipulate files larger than the text buffer.

The review also said that the spooling system gave priority to the printer. This is necessary to ensure that Magic Wand works in all CP/M environments, but as the manual states, 'your dealer may be able to make a minor change,' which will in effect reverse the priorities.

The only other major omission from what was otherwise a very thorough review is the fact that Magic Wand now supports proportional printing elements on daisywheel printers, allowing different spacing for each letter.

Since your review went to press, the Magic Wand

system has been acquired by Peachtree of Atlanta, Georgia, and is now fully supported by that company. They have issued a new release of Magic Wand, version 1.11, which corrects a number of very minor bugs in the last version from Small Business Applications Inc.

Tim Frost, Roundhill Computer Systems, Marlborough, Wilts

Zilog writes

My attention has recently been drawn to an article which appeared earlier this year in *PCW*. The article in question was a review of the Onyx C8002 microcomputer written by Sue Eisenbach.

While not being in a position to comment on the Onyx C8002 system itself, I should like to clear up several inaccurate and misleading statements which were made in this article concerning Zilog's Z8002 family microprocessor products.

1. While talking of the Z8000 your article states: '... originally it was designed to be supplied in two versions: the Z8001 had a total of 45 distinct instructions... and could address 8 Mbytes via memory management hardware while the Z8002 had... slightly fewer instructions.' There are several errors in the above statement: a) It is true that the Z8000 is supplied in two different versions; the Z8001 and Z8002. The difference between the two is in the size of memory that can be directly addressed. The Z8002 which addresses a smaller, 64 kbytes is packaged in a smaller, lower cost package, making it a lower cost device. However, the chip is identical in both Z8001 and Z8002, the difference being achieved by a bonding option during manufacture. Consequently both parts have always been equally readily available from Zilog. b) Both Z8001 and Z8002 have identical instruction sets of 110 basic types which may be combined with the various addressing modes to give over 400 different opcode combinations. Larger address values, of course, exist in the Z8001 instructions due to the larger address space. In all other respects the instruction sets are binary compatible. c) The 'memory management hardware' is a separate

component which may be used with the Z8001 to help manage the large address space. It is not essential to use this as the Z8001 can address 8 Mbytes without the Memory Management Unit (MMU). However, the MMU provides powerful memory segmentation and protection features to assist in the management of large address spaces.

2. Your article mentions a third version of the Z8000 which we have announced. This is the Z8003 which will be available early next year. It is a further enhancement which will be fully compatible with Z8001 but provide virtual memory support. Contrary to the impression conveyed in your article, the various Z8000 versions represent a deliberate policy by Zilog to provide a range of price and performance options while at the same time providing compatibility across the range and a growth path for the future. Surely this is desirable.

I hope you will take action to correct any misunderstanding which may have been created in the minds of your readers.
Phil Pittman, Zilog (UK) Ltd, Maidenhead, Berks.

Elvers wanted

I am writing to you in a desperate attempt to try and contact another owner of an ELF II (if one exists!). I was looking through several of my magazines, which consist mostly of your great magazine, and I didn't see a letter or program to do with the ELF II. Is it that we are extinct or endangered species and afraid to speak out?

I have been computing for two years now and I bought the basic ELF II a year ago with some money that I had for Christmas. With the release of the Sinclair ZX80 and now the '81 it is very frustrating to know that I have spent over £150 and I still don't have a system equivalent to this, but rather than sell my ELF II, I am going to stick at it and hope that there is another ELF owner out there who would be willing to exchange programs with me.

I am a computer freak but I cannot think up hundreds of programs and have great difficulty in writing machine code programs. I am willing to pay for software and I would be only too pleased to write programs for other ELF owners, especially as I have now got Basic.

I have been looking for a job in computing, as I am 16, and I have had no luck, but I am determined to keep in the computing industry and perhaps I will get a job as a trainee somewhere, but while I stay on in the sixth form with the free time that I have I write programs for

my ELF and I feel that if someone can have fun with one of my programs then why shouldn't they. I do hope that you can help me as it would be helpful to be able to talk to someone who understands 1802 machine code instead of the usual 6502 or Z80.

Tony Higham, 24 Linford Crescent, Coalville, Leicestershire

Basic balance

Basic has recently taken the brunt of much undue criticism in the computer oriented press. In writing this letter I hope to look at both sides of the argument in a few simple statements.

1. The great majority of readers of this magazine would not be doing so if Basic were not the 'standard' language. Basic has 'humanised' the computer.
2. Any Pascal devotee should try convincing a 14 or 15 year old that he should abandon Basic in favour of Pascal. To use Pascal effectively requires deep thought and careful planning that many enthusiastic children cannot yet be bothered to do. Computers will be used extensively in the future and we should not raise barriers (such as the requirements of Pascal) to the everyday use and acceptance of computers in our society.
3. We must remember that Pascal too has a few badly thought out features, one such being the use of `:=`. Many users of Pascal treat this as an improvement, because it removes the ambiguity of statements such as:

IF X=4 THEN Y=Z+3

But where is the ambiguity?

The IF part is clearly a condition and the THEN part is clearly a consequence. A wily compiler should distinguish between these. Since when were primary school children taught that $2 \times 3 := 6$? (or is this already in hand?)

4. There has been much criticism of interpreters compared with compilers. A compiler is useful for the fast running of perfected(?) programs, but it is an obstacle if a program is merely being developed. It can take three or four minutes to insert a missed space or colon (about which Pascal has very tight rules) and get the program running again, but with an interpreter it takes only a few seconds to correct the error. A compiler could then be used on the finished product.

So what should be done? A structured Basic seems the best idea so that one can progress from simple Basic to structured Basic without the need to learn a whole new language. After all, we do want people to use computers, don't we?
Jonathan Palmer, Currie, Midlothian

Manual moans

Why are computer and software manuals so predictably awful?

We seem to have tested a sackful of manuals recently for our new Pet 8000, in normal office conditions with secretaries unfamiliar with computers. The result? Every manual contained a major flaw or, in some cases, was totally incomprehensible. After three months of largely futile experimentation, we have now written our own 'manual' for the Wordcraft program. Otherwise, we simply could not have used it.

The appalling documentation for the Pet itself is well known — most of the instructions are simply unintelligible. But less discussed perhaps are the inadequacies of the manuals for the Sinclair ZX80, OZZ and DMS data management programs. The manual for Wordpro 4 is virtually incomprehensible, and was the sole cause of our refusing this program.

Some programs romp along cheerfully for a few pages, giving the illusion that here is a manual that can be actually understood. Then either the printer advances his schedule or the writer succumbs to programmers' elbow, and vital instructions are telescoped into an impossibly short space. For example, the ZX80 manual includes some of its more important functions in a tiny chapter 'A ragbag of functions'. It mentions 'arrays' in a paragraph, without explaining what they are or why they are used, then leaves the hapless purchaser struggling with sundry functions like RND (what? why?), before signing off — with no indication of what he can now do with the computer by way of games, programs, etc.

The OZZ manual is beautifully laid out, but unless you are a stock control clerk, the example programs given are valueless — and little help is forthcoming in using the program for more advanced functions, eg survey analysis. DMS leaves the layman struggling after page 6. Even Wordcraft, one of the better manuals, contains nonsense instructions that, if executed literally, are rejected. And so on.

Can I suggest to all manual writers this simple routine: 'Tell it to Bridget'. Select a lay typist unfamiliar with computers. Give her the hardware and manual for a week-end. Then prepare your blushes for a list of protests and queries. And, please, never never release a manual on the market until several non-specialists have debugged its computerese and unexplained leaps of logic.

Or is this too simple for

the rapacious 'launch now, apologise later' world of micro-computer?

Nick Robinson, Luton

On-line

Alan Sutcliffe (Letters April 1981 issue) presents a less than fair picture regarding the position of online information services in Britain. The British Library has had a highly successful operational online information retrieval service since 1977. This service called British Library Automated Information Retrieval Service (BLAISE) offers access to files a) with comprehensive coverage of the journal literature of medicine and toxicology and b) with comprehensive coverage of all books published in the United Kingdom since 1950 and in the United States of America since 1968. The software, ELHILL, for this service was developed by the National Library of Medicine in Washington but the British Library has also developed its own software, EDITOR, which enables libraries to edit and create records for their catalogues which are ultimately available on microfiche.

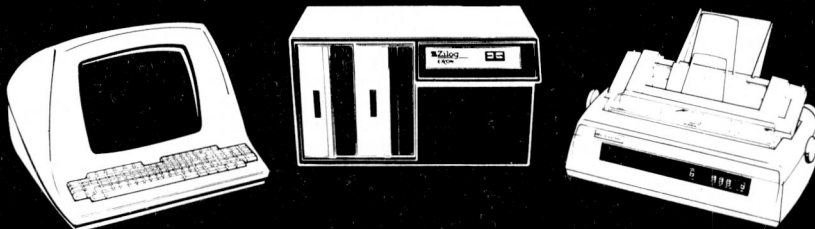
The British Library has completed some work on the development of its own retrieval software to run on an ICL computer. However because of financial problems the project entitled MERLIN has been shelved.

The BLAISE service is operated on a commercial basis and is widely used by libraries in the United Kingdom and Europe. Many libraries including some public libraries offer access to BLAISE and the American services such as Lockheed DIALOG and ORBIT. The charging policies vary but the tendency is to charge £1 per connect minute. The average time per search is no more than 15 minutes, so the comment that it may be cheaper to fly to Washington and back than to use a commercial database is very far from the truth.

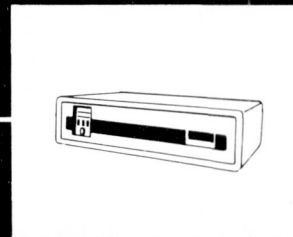
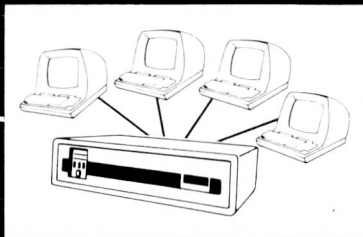
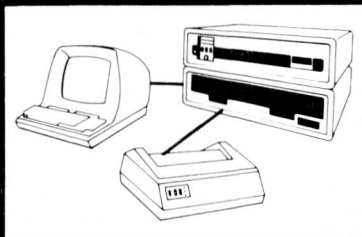
There is no doubt that the United States of America is at the Vanguard of the online information retrieval area. However, to dismiss the efforts of the British Library in the way Mr Sutcliffe has done is to ignore the realities of the situation.
Robin Frederick Guy, Aberystwyth



START SMALL



GROW BIG



With Zilog SYSTEMS

The modular design of Zilog's MCZ series of microcomputer systems allows you to start small and grow big – in a variety of directions, whether you are a dealer, a software developer, OEM or end user.

START SMALL with Zilog's inexpensive but fully supported MCZ-1 floppy disk systems and accounting software, designed for the first-time small business user. Add software from a wide range of packages, including word-processing and, as business expands, increase the machine storage with plug-in cartridge disks.

GROW BIG with Zilog's Z-NET local network systems. Start with a 2 Mbyte floppy disk MCZ-2, based on Zilog's own Z-80A processors. Add the network interfaces and connect your microcomputer stations to allow sharing of data, printers, modems and other expensive peripherals. Allow yourself flexible growth without loss of performance; and remember that Zilog promises gateways to future local network standards.

Zilog's General Systems products are based on Zilog's own Z-80 and Z-80A processors and have enviable records of reliability. Zilog's own support and service

organisation, ensures that your investments in hardware and software are protected as your business grows.

THINK BIG. Fill in the coupon and let us show you how we can grow together.

**To: Zilog (U.K.) Ltd.,
Babbage House, King St., Maidenhead, Berks SL6 1DU Tel: (0628) 36131**

Please send me information on the exciting range of Zilog systems.

Name

Company

Address

Position

Telephone

Possible dealer YES/NO

Possible customer YES/NO



PCW

SHARP PC-3201



Lyn Antill puts another Japanese newcomer through its paces.

After the successful launch of the MZ-80K personal microcomputer, Sharp has now launched an attack on the small business computer market with the PC-3201. The machine has been specially geared to the business market rather than trying to make a machine which offers something for everyone. This approach is quite the opposite of that adopted by Transam for the Tuscan, which I reviewed a few months ago. In fact, Sharp was rather concerned to hear that we tested machines for speed in performing calculations and loops, making the point that speed was not so important as accuracy and so had used binary coded decimal format for the arithmetic in order to get more significant figures than were possible with the normal Z80 arithmetic.

The Benchtest machine was provided complete with peripherals and with a range of business software that Sharp had commissioned from Padmede especially for the PC-3201. The aim is to produce a reliable, business-like machine with the level of software and support that the non-computing businessman would value.

Hardware

The system arrived in four boxes, all of which could be carried comfortably. This only matters if you are in the habit of carrying your computer around — but then I am, and mine's heavy! The four components are the computer with built-in keyboard, the VDU, the disk drives and the printer. To complete Sharp's 'support the user' image, the salesman also delivered a dust cover and a four-way extension to plug all the units into.

All the units are in shiny grey plastic and have a sleek professional look to

them. However, John Cleese might be able to point to the 'platefuls of spaghetti' at the back. The main box measures 18in x 14in x 4in at its deepest and the PCBs are specially designed to fit in.

The VDU is particularly nice because it comes on a swivel so that you can adjust the screen up or down and then fix it at the required angle. It sits on a base plate which fits under the computer/keyboard unit and which permits a bit more adjustment of the actual position of the screen, yet the whole thing still looks like one unit rather than a box with a TV on top. The colours used are green on black and there is a separate brightness control. The 12in screen can have 80 by 25 chs including a wide range of graphics, or it can be run with 40 by 12 double-size characters.

The standard qwerty keyboard has a good feel to it. The cursor control keys are located at the top right of the letter pad and there is a separate numeric pad. Ten function keys are provided for user definition as well as some pre-defined keys such as RUN and HALT. One additional switch on the keyboard transfers the machine between programming and operational mode. When this is set to OP, only program execution and manual operation are permitted.

The Benchtest machine had twin 5in floppy drives, although it is apparently possible to use as many as eight disk drives, four each on two separate channels. I can't imagine wanting to juggle eight sets of floppy disks! An Epson printer was used. This is capable of bidirectional printing and doing a good range of graphics characters which Padmede uses to good effect in creating the printouts on the commercial software.

The PC-3201 is built around a Z80 microprocessor. It has 32 kbytes of ROM and 64 kbytes of RAM which can be extended up to a maximum of 112 kbytes. The video display is memory-mapped into RAM and the keyboard can be used to generate graphics characters in much the same way as on a PET, except that the graphic symbol associated with each key is not shown on the keyboard but on a separate chart. There are 44 of these altogether. Quite a few keys can be used in conjunction with the command key 'CMD' to serve as abbreviations when entering commands, eg, 'CMD' '1' is equivalent to 'DISP'. This can be time-saving for the programmer, although I doubt if the casual user would remember them.

There is even a three-octave music function so that you can write melodies by specifying the tempo and the pitch and duration of each note. One of the programs I tried out did a convincing version of 'uh! uh!' every time you made a mistake.

Software

FDOS is the operating system used and the only language available is a very extended version of Basic. Although FDOS does claim to be capable of supporting other languages, none was actually mentioned.

The manual tells you very little about FDOS except that it is used for handling disk Basic files. Again Sharp is working on the assumption that it is dealing with users rather than hobbyists or programmers. The FDOS commands available are: Basic, Init, Cat (to list the files on a disk), Backup (to create a copy of a whole disk, protection levels and all), Copy (for individual files), Killall (to clear a disk), and Debug. Init seems to be very slow, although I was assured that it does verify each track as it initialises it.

Two manuals come with the system; one covers the computer and the other deals with the disk-based operations. Both are pretty well full of Basic instructions. Indeed, it's the largest Basic I've ever used, with about 100 instructions. There are all the usual ones plus a whole lot of others, mostly to use the special features of the machine such as Music and the function keys, which can be turned on and off at various points in the program. There are also a whole lot of display statements to make use of the extensive screen facilities. The cursor can be moved to any character position on the screen with the CURSOR instruction, while MVCUR moves the cursor on so many from its previous position. The screen can also be treated as a 160x50 array of points of light, each one of which can be set on or off by SET X,Y or RESET X,Y. The POS A,B instruction will return the position of the cursor at the time. It is possible to set fields into reverse video or make them blink and there is a COLOR instruction for machines with a colour monitor.

There is one very natty screen instruction -- TABLE. This permits you to give a list of column and row sizes and it will then create a lattice of horizontal and vertical lines. This is extremely useful for input, as much of the information which a businessman wants to put into his micro comes in precisely that tabular form -- invoices, stock

records, etc. You even get a choice of whether the lines around the table should be set straight or made up of fancy characters like asterisks.

The display instructions and those for trapping function keys might seem like fancy frills, as the normal Basic instructions could be used to handle them; but human beings are the most expensive part of any computer system and anything which can regularly save lines of code throughout a program is of great commercial value, especially where it also permits programs to be written in such a way that they are quick and easy to operate.

Another factor which leads to efficiency in programming is the use of libraries of subprograms to do routine jobs. These subprograms need to be callable from the main program. This is done by a simple LOAD SUB command which adds the subprogram into memory with the main program. There is also a CHAIN command which calls the next program from a program which has finished, so that several programs may be executed in a predetermined sequence.

An ALOAD command causes a predetermined program to be called in and executed as soon as the program has been switched on. This is an extremely useful feature for the commercial user because it means that the operator has only to load the FDOS master disk with the required program on it and then simply switch on.

Video display can be stored in RAM and called up when required with VSAVE and VLOAD. KSAVE and KLOAD will do the same for definitions of definable keys. Both of these are very useful for simplifying and standardising the use of the screen and of the function keys.

As expected, the Benchmark times were very slow. It also took 70 seconds to auto-load a program from switching the machine on to being ready to load the data disks. This sort of delay is irritating when you are swapping from one program to another, but would be trivial if the same program was to be run for a long stretch. In fact, auto-loading in this way is actually quicker than loading a system disk, then a program disk, and then typing the name of the program to be executed. However, a much more significant point was the accuracy with which calculations can be done. To test this, I took the exchange

rate calculations with which I am familiar and tried them on the Sharp and on my Tuscan (which doesn't have double precision) and compared the results: \$1,250,000.00 at 2.232 gave an answer correct to .01 of a penny on the Sharp, whereas my Tuscan only gave the answer as a whole number of pounds, £2 out, and was quite incapable of dealing with the pennies. So, if you want to get correct answers to calculations involving more than £1000 (and most businessmen do) then you will probably agree with Sharp in putting accuracy before speed.

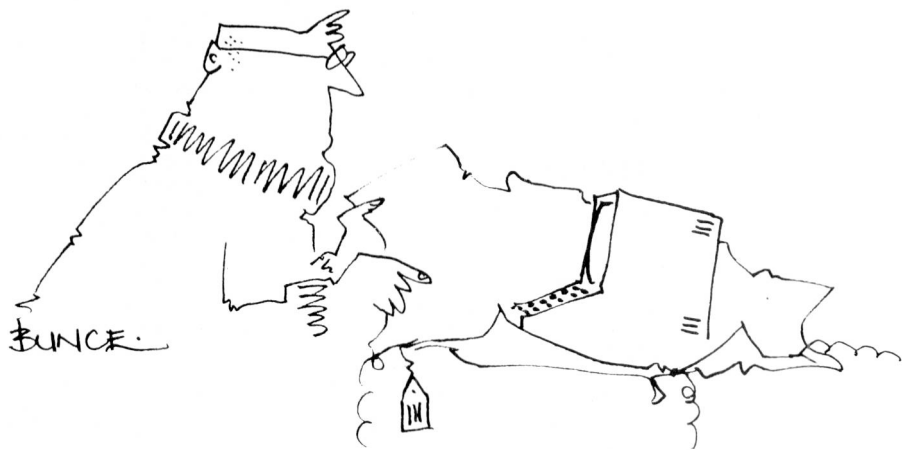
Commercial programs

The business software which Sharp commissioned from Padmede Computer Services consists of Sales Ledger, Purchase Ledger, Sales Invoicing and Nominal Ledger. The versions provided for the Benchtest were the demonstration ones used by dealers. These were primarily used to show what the PC-3201 was capable of doing, rather than to Benchtest the software itself.

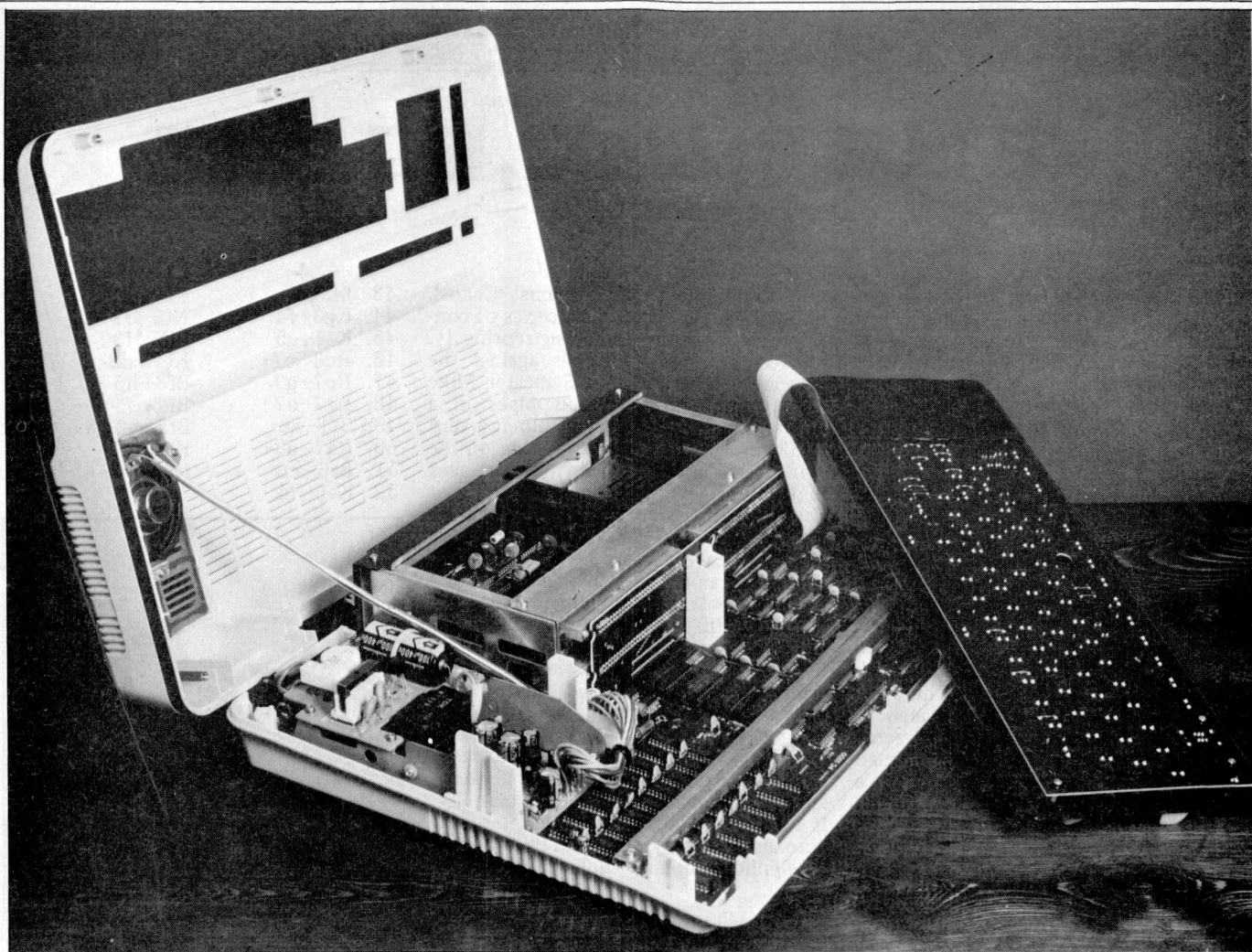
Fourteen seconds after switch-on, a large video display announced that the program is loading. The programs work on the menu principle, and make good use of the excellent graphics facilities. They are self-explanatory and easy to use and certainly appear to be doing the right sorts of things, although I wasn't able to test the difficult bits, such as security and backup. My accountant was a little puzzled by some of the VAT calculations but was able to get the right answers in the end.

The slowness of operation is not really apparent, except when loading, and is certainly not a problem, because the speed of running a commercial program usually depends on the speed of keying. If you have a heavy workload and still want a good-looking machine with a good service reputation and the same facilities as the Sharp, then you must reconcile yourself to paying more for the extra speed.

I have a 'thing' about documentation and I was a little disappointed by the manuals that go with the Padmede programs -- I would have liked a bit more help in using them. But they did include plenty of examples, which is always helpful.



'It took you precisely eight minutes 47.09 seconds to open this parcel -- you certainly do need me!'



Inside and outside the PC-3201.

Support

The commercial user is much more concerned about this than the hobbyist or even the educational user. If the machine that produces your invoices goes down, you don't send any invoices and you don't get any money. Sharp is aware of this and is trying to restrict dealerships to those capable of doing the sort of hand-holding and backup the users need. So far Sharp has only authorised 50 suppliers.

Conclusion

Don't buy this machine if you want fast processing, or lots of languages, but if you are a commercial user wanting to do straightforward jobs accurately and stylishly then the PC-3201 is well worth considering. The minimum con-

figuration of 64k processor, twin 5in double-sided, double-density floppies, printer and 12in screen costs just under £3000, which certainly represents good value.

At a glance

This is a good-looking, apparently reliable and well-supported business computer with a very extended Basic, good graphics (and music!) and a range of standard business programs. The minimum configuration costs £3000. The keyboard is excellent and so is the adjustable screen, except that there are no true descenders.

Drawbacks are that it only supports Basic, and that it is extremely slow. It is already a good, reliable business machine, and if Sharp's software experts

can speed it up and provide a wider range of languages and applications, it could be super.

Benchmark timings (in seconds)

1	4
2	13.5
3	35.5
4	35.5
5	38.5
6	67
7	108
8	25

Reading 100 random records: 70
Writing 100 random records: 70

Hardware prices

PC-3201	64k CPU	£1500
CE 320C	80 x 25 CRT	£250
CE 332P	Dot matrix printer	£450
CE 331M	Twin disk unit	£670
CE 341M	Floppy interface card	£125
CE 350L	Additional cable	£30

Software prices

Sales Ledger	£300
Purchase Ledger	£300
Invoicing System	£300
Nominal Ledger	£450

BELLE, BELLER, BELLEST

I find it hard to accept that Belle, the World Computer Chess Champion, is a micro. However, Belle's principal creator, Dr Ken Thompson of Bell Labs (and Unix fame), argued tenaciously that it might reasonably be considered to be so. This raises some important questions on which I would like to hear your views; for the purpose of a chess tournament, what is a micro? However, for the sake of argument and so that I can tell you something about the World Computer Champion in this column, let's accept Dr Thompson's argument.

Those who attended the recent conference on Advances in Computer Chess at Imperial College heard Dr Thompson talk about his chess machine. Since most of you were not present, here are some of the details which he revealed.

Belle is now in its (her?) third generation. The original Belle was a small piece of special hardware which was a good enough player to finish equal fourth in the World Computer Championship in Toronto in 1977. Finishing 1½ points behind the winner (Chess 4.6) in a four-round tournament seems to have acted as a spur to Dr Thompson.

The second incarnation of Belle followed about a year after the Toronto tournament and again took the form of special chess hardware (LSI/11, move generator, move evaluator and associated memory). This hardware, with 256k main memory and 1 Mbyte of 'associated memory' (used for storing a look-up table of about 100k chess positions) performed quite well and achieved a respectable rating of 1900 on the World Chess Federation scale.

It is, though, the third machine, which adds a PDP-11 and a 35 Mbyte Winchester (used principally for the openings book of 300k positions) to the special hardware, that has attained formidable strength and which won the World Championship in Linz last year. The rough chronology of its development during 1980 was: February — basic design; May — finalisation of design; June — construction; July — development; 20 July — the machine made its first half-move; at the beginning of August it played its first game, losing to the old Belle program; 6 August — it beat the old program convincingly; 8 August — first games played against a human opponent, winning two games of '30-30' (each player has 30 minutes' thinking time to make 30 moves) against a master strength player; late August — played its first tournament in preparation for Linz; September — program still being debugged and it played its second tournament since when the program has not changed significantly (erasing and blowing 256 PROMs is something of a deterrent to fixing even major bugs).

At the end of last September, Belle tied for first place in the World Computer Championship in Linz and then

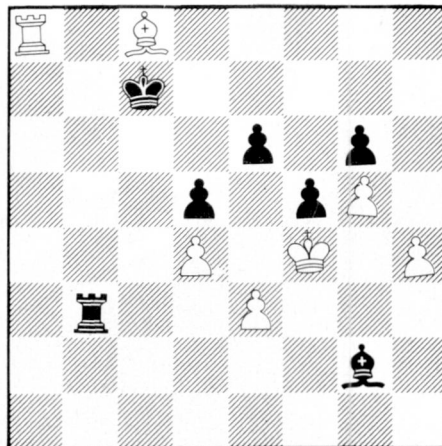
won the play-off match against 'Chaos'. Since then, Belle has had a series of considerable successes, including scoring 1½ out of 2 in 30-30 games against the internationally known US master Mike Valvo and taking second place in a human master tournament (albeit a very weak one). Belle's current rating on the world scale is 140, but its performances in the last year have been running at about 2320 — and that is better than several of the world's 300 or so active International Masters.

That is an amazing achievement for a pure brute force program, even analysing 160,000 nodes per second. No less amazing is the following game played on 9 August last year, less than a week after the program started playing. The West German Grandmaster Helmut Pfleger (one of the 100 or so best players in the world) was given a simultaneous display against 26 opponents, apparently all humans, for German TV. It turned out, however, that one of the humans was relaying moves to and from a telephone line to Bell Labs in New Jersey.

White: Helmut Pfleger (rating 2525)
Black: Belle (rating 1900)

- | | |
|----------------|-------------|
| 1. d2-d4 | d7-d5 |
| 2. c2-c4 | c7-c6 |
| 3. c4xd5 | c6xd5 |
| 4. Nb1-c3 | Nb8-c6 |
| 5. Ng1-f3 | Ng8-f6 |
| 6. Bc1-f4 | Bc8-f5 |
| 7. e2-e3 | e7-e6 |
| 8. Bf1-b5 | Nf6-d7 |
| 9. O-O(Ke1-g1) | Bf8-e7 |
| 10. Qd1-e2 | Ra8-c8 |
| 11. Ra1-c1 | Bf5-g4 |
| 12. h2-h3 | Bg4-h5 |
| 13. g2-g4 | Bh5-g6 |
| 14. Nf3-e5 | Nd7xe5 |
| 15. Bf4xe5 | O-O(Ke8-g8) |
| 16. Be5-g3 | f7-f5 |
| 17. Bb5-d3 | Be7-d6 |
| 18. f2-f4 | Bd6-b4 |
| 19. g4-g5 | Qd8-e8 |
| 20. a2-a3 | Bg6-h5 |
| 21. Qe2-d2 | Bb4-a5 |
| 22. b2-b4 | Ba5-b6 |
| 23. Kg1-h2 | Rf8-f7 |
| 24. Nc3-b5 | Rf7-d7 |
| 25. a3-a4 | a7-a5 |
| 26. b4xa5 | Bb6xa5 |
| 27. Qd2-b2 | Ba5-b4 |
| 28. Bg3-e1 | Bb4xe1 |
| 29. Rf1xe1 | Qe8-d8 |
| 30. Qb2-a3 | Bh5-f3 |
| 31. Kh2-g3 | Bf3-h5 |
| 32. Rc1-c2 | Qd8-a5 |
| 33. Re1-c1 | Rc8-a8 |
| 34. Nb5-d6 | Qa5xa4 |
| 35. Qa3xa4 | Ra8xa4 |
| 36. Nd6xb7 | Rd7xb7 |
| 37. Rc2xc6 | Ra4-a3 |
| 38. Rc1-c3 | Ra3xc3 |
| 39. Rc6xc3 | h7-h6 |
| 40. h3-h4 | Kg8-f8 |
| 41. Bd3-a6 | Rb7-b6 |
| 42. Ba6-f1 | h6xg5 |

- | | |
|-------------|--------|
| 43. f4xg5 | g7-g6 |
| 44. Kg3-f4 | Kf8-e7 |
| 45. Kf4-e5 | Bh5-f3 |
| 46. Rc3-c7+ | Ke7-d8 |
| 47. Rc7-g7 | Bf3-h5 |
| 48. Rg7-a7 | Bh5-f3 |
| 49. Bf1-a6 | Bf3-g2 |
| 50. Ra7-a8+ | Kd8-c7 |
| 51. Ba6-c8 | Rb6-b3 |
| 52. Ke5-f4 | |



- | | |
|-------------|---------|
| 52. ... | e6-e5+ |
| 53. Kf4xe5 | Rb3xe3+ |
| 54. Ke5-f6 | f5-f4 |
| 55. Bc8-e6 | Kc7-b6 |
| 56. h4-h5 | g6xh5 |
| 57. g5-g6 | f4-f3 |
| 58. Be6xd5 | Bg2-h1 |
| 59. Ra8-a1 | f3-f2 |
| 60. Ra1-b1+ | Kb6-c7 |
| 61. Bd5xh1 | Re3-e1 |
| 62. Bh1-g2 | Re1xb1 |
| 63. g6-g7 | Rb1-g1 |
| 64. g7-g8Q | f2-f1Q+ |
| 65. Bg2xf1 | Rg1xg8 |
| 66. Bf1-h3 | Kc7-d6 |
| 67. d4-d5 | h5-h4 |
| 68. Bh3-e6 | Rg8-g3 |

White resigns.

Whether or not Belle should be counted as a micro, the micro chess machines are making great progress. One of the mini-micros that I am associated with, the Chess Champion Mk V, played a couple of games against the second-generation Belle during the computer conference, winning one and drawing one, which establishes that at about 1900, and the new Morphy machine from ACI is close behind — Danny Kopec, another speaker at the conference, assessed its rating at about 1850.

The 2nd European Microcomputer Chess Championship

Don't forget — the Second European Microcomputer Chess Championship
GOTO page 157

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.⁹⁵ per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

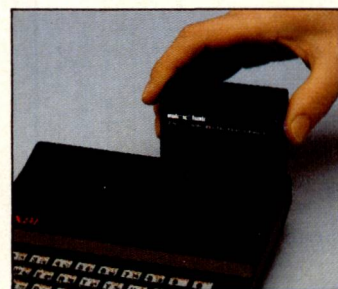
The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 and the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.



Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J.H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and

retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

Sinclair ZX SOFTWARE

Sinclair Research Ltd,
6 Kings Parade, Cambridge,
Cams., CB2 1SN. Tel: 0276 66104.

To: Sinclair Research, FREEPOST 7, Cambridge, CB2 1YY

Please print

Please send me the items I have indicated below.

Qty	Code	Item	Item price	Total
	21	Cassette 1 – Games	£3.95	
	22	Cassette 2 – Junior Education	£3.95	
	23	Cassette 3 – Business and Household	£3.95	
	24	Cassette 4 – Games	£3.95	
	25	Cassette 5 – Junior Education	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*Post and packing (if applicable)	£2.95	
			Total £	

*Please add £2.95 to total order value **only** if ordering ROM and/or RAM.

I enclose a cheque/PO to Sinclair Research Ltd for £

Please charge my Access*/Barclaycard/Trustcard no.

*Please delete as applicable.

Name: Mr/Mrs/Miss

Address:

SOFO2



SHOGI

David Levy looks East for this month's game.

This month I wish to introduce readers to a game which they will almost certainly never have come across. It is related to chess, but has an added dimension of complexity which can result in exciting sequences being sustained for very many more moves than in chess. This game is so popular in its country of origin (there are some 19 million players) that those who excel at the game often become millionaires, and are held in greater esteem than Bjorn Borg in Sweden or Kevin Keegan in England. I am referring to shogi, or Japanese chess, and I can recommend the game very highly to anyone who enjoys 'western' chess. My shogi-playing friends have been trying to persuade me for some time that 'western' chess is an inferior form of the game and, although I have yet to be firmly convinced by their arguments, I must confess that shogi does have enormous appeal. Since it is well known that computer programmers usually show great aptitude for chess, it is likely that among the readers of this magazine there are many potential shogi masters (or dans as they are known in Japan), and many thousands who would enjoy the game if they took an hour or so to learn how to play it.

Japan is the Mecca of shogi, but during the past few years an organisation has grown up in the western world whose aim is to popularise the game outside its native country. The Shogi Association, PO Box 77, Bromley, Kent, England welcomes new members and will supply shogi sets and elementary literature to those who cannot find them elsewhere. It also publishes a regular magazine and holds meetings in London. Through the efforts of the Shogi Association there have been shogi tournaments held in London, for which leading Japanese players have flown half way round the globe, and in last year's tournament I was able to see my colleague Larry Kaufman, an International Chess Master from the USA who seems to have abandoned the 'inferior' form of the game for its Japanese counterpart. I understand that he has now become completely addicted, to the extent of travelling to Japan in the hope of becoming a professional shogi player.



How to play Shogi

The best way to learn the game of shogi is to buy a copy of *How to Play Shogi* by John Fairbairn, and to study this slim volume with a shogi set in front of you. Although shogi sets normally have the pieces inscribed in Japanese characters, the Shogi Association imports sets in which the pieces also have westernised lettering as well as arrows to show you how each of them moves. It should take no longer to learn the moves at shogi than to learn how to play western chess, and I am reliably informed that one can even get used to the Japanese symbols rather more quickly than one might suspect. Since the main point of this article is to enable the reader to write his own shogi-playing program, I must begin with a précis of the rules and moves of the game.

Each player starts the game with 20 pieces made of wood or plastic. These pieces are uniform in colour, but for the sake of convenience we call them Black and White, as in chess. The game is played on a 9 x 9 board (does anyone

know of a 9-bit processor?) with the two armies set up in the following starting position:

9	8	7	6	5	4	3	2	1
1 人	X S	* D	* K	* D	X S	人 N	1 1	
	+					X B		
1 d	1 d	1 d	1 d	1 d	1 d	1 d	1 d	1 d
P f	P f	P f	P f	P f	P f	P f	P f	P f
	B X						R +	
1 l	N Y	S X	G *	K *	G *	S X	N Y	1 l

Fig 1 The starting position in shogi.

The pieces and their moves

KING: Each player has one king and, as in chess, the object of the game is to checkmate the opposing king. As in chess the king can move one square in any direction (horizontal, vertical or diagonal).

GOLD GENERAL: At the start of a game each player has two golds. The gold moves one square at a time, vertically, horizontally, or diagonally forwards. It may not move diagonally backwards.

SILVER GENERAL: Each player has two silvers. The silver moves one square at a time, diagonally or forwards. It may not move sideways and it may not move straight backwards.

KNIGHT: Each player has two knights, whose move has the same form as the knight in chess but with the restriction that it may only move two squares forwards and then one square to the left or right. So whereas a chess knight has eight moves at its disposal from a central square on an empty board, a shogi knight will have only two possible moves, but as in chess it may jump.

LANCE: Each of the two lances moves straight forwards as far as it likes, but it may not jump.

ROOK: The shogi rook moves exactly like its counterpart in western chess, in a straight line as many squares as it wishes. There is no queen in shogi, so the rook is usually regarded as the most powerful piece.

BISHOP: Again this piece moves just like a chess bishop — any number of squares in a diagonal direction.

PAWN: As in chess, the initial shogi position has a row of pawns across the board. Since shogi is played on a 9 x 9 board, each player begins the game with nine pawns, which can move one square forwards. There is no double pawn move when a pawn makes its first move; there is no diagonal capturing move; and there is no such thing as an en passant capture.

Promoted pieces

One of the most interesting aspects of shogi, as compared to chess, is the fact that whereas in chess only the pawns can promote to a piece of higher value, in shogi some of the other pieces can also promote. A promotion move is made by moving a piece partly or wholly within your promotion zone (the last three ranks or rows furthest from you). Promotion takes place at the conclusion of the promoting move, and it is important to remember that in shogi it is not always compulsory to promote, as we shall see. The following pieces have the ability to promote:

SILVER: The promoted silver moves exactly like a gold. On your shogi set the silver can be turned over and on the reverse side you will see the symbol for a promoted silver.

KNIGHT: The promoted knight also moves exactly like a gold.

LANCE: The promoted lance moves exactly like a gold.

PAWN: The promoted pawn moves exactly like a gold.

ROOK: When the rook is promoted it retains its original ability to move any number of squares horizontally or ver-

tically, and acquires the extra ability to move one square in a diagonal direction. **BISHOP:** Similarly, when the bishop is promoted, its original move is retained and it has the new ability to move one square vertically or horizontally.

If a pawn or lance moves to the last rank, or if a knight moves to either of the last two ranks, promotion is compulsory. At all other times, promotion is optional.

Capturing

If a player moves one of his pieces onto a square that is occupied by one of his opponent's men, the opponent's piece is captured as in chess. But here lies one essential difference between the two games, and it is this difference that adds an extra dimension to the game of shogi.

In chess, when you capture one of your opponent's pieces it is removed from the board forever. In shogi you keep this piece 'in hand', and later in the game you may drop it onto any vacant square (subject to a few restrictions). The drop is made instead of moving a piece from one square to another, and it is important to remember that a piece may only be dropped in its unpromoted state, even if it had been promoted before it was captured. When you drop a captured piece onto the board it becomes your own piece, and for this reason the capture of an enemy piece has a double significance. One interesting aspect of the drop is the fact that you might well decide to sacrifice a valuable piece on one part of the board in return for an inferior one, simply because you want to be able to drop that inferior piece on another part of the board within the next few moves.

Check and checkmate

When a king is attacked it is said to be in check, just as in chess, and the player who is in check must take evasive action immediately — moving his own king, capturing the checking piece, or interposing a piece between the two. If the king is attacked and there is no way to save it, the player has been checkmated. Since all of the pieces are, in practical terms, in play throughout the game, it is extremely rare for a game of shogi to end in a draw. In chess the number of the pieces on the board is gradually reduced as the game progresses, and when sufficient reduction has taken place the game will inevitably end in a draw. Those who find master chess games boring because too many of them (some 55 percent or more) are drawn, need have no such fear regarding shogi.

How to program Shogi

There is no reason why most of the principles that apply to chess programming cannot also be applied to shogi programming. Growing and searching a game tree is the obvious approach, the most serious problem being the large branching factor caused by the increased number of pieces (40 instead of a maximum of 32) and the possibility of the drop. If you hold just

one type of captured piece 'in hand' you will have 42 or more squares on which it may be dropped. It is easy to see how the number of legal moves at one's disposal can easily increase to 150 or 200, once two or three enemy pieces have been captured. Clearly it is necessary to find some way of reducing the list of legal moves to produce a list of plausible moves which is of manageable size. The answer to this problem lies in the use of intelligent shogi heuristics, or 'proverbs' as they are known in the trade.

Anyone who is interested in writing a chess program need only refer to the enormous wealth of chess literature in order to find a number of heuristics which can be employed in a plausible move generator or an evaluation mechanism. A lot has also been written about shogi, but unfortunately for most readers of this article it is almost entirely published in Japanese, and if your Japanese is anywhere near as bad as mine is you will not relish the thought of ploughing through tomes of mysterious symbols. Here I have space for only a very small number of heuristics, and I must recommend the reader to take a look at the extensive list which can be found at the back of Fairbairn's booklet. In addition, those of you who would like to make your shogi programs as strong as possible ought to join the Shogi Association and try to obtain all the back numbers of *Shogi magazine* (issue 1 is sold out — Ed.), in which the most important proverbs are explained. Once you understand a proverb, it is an easy matter to convert it to numerical form so that it can form part of the evaluation/plausibility mechanism.

Shogi openings

The exact order in which the opening moves are played does not appear to be so critical in shogi as it is in chess. The most important aspect of opening play in shogi seems to be the squares on which one places one's pieces, and not the exact order in which they are moved there. The only source of shogi openings that I can find in any language other than Japanese is, once again, that published by the Shogi Association.

Since it is not necessary for your shogi program to have access to large tables of opening variations, you need only devise some method of encouraging the program to make moves that will lead to its pieces being on the right squares. A simple method of accomplishing this is to examine each of the pieces in a desired formation and determine how many moves away from its target square it is at the moment. The 'opening' feature in the evaluation function can then be penalised by (say) 1 point for each piece that is one move away from its target square, 2 points for each piece that is two moves away, and so on. This method, or any similar pattern-matching process, will provide a useful measure as to the degree to which a desired opening formation has been achieved.

The middle game — a few heuristics

As in chess, the middle game in shogi sees most of the manoeuvring and

NASBUS NEWS

COMPATIBLE

More great deals from 6 Nascom Dealers

A NASCOM-2 BASED SYSTEM FOR £1549 + VAT

The proven Nascom-2 microcomputer can now be bought as a complete system from £1549 + VAT. For this price you get the Nascom-2 kit, 16K RAM board kit, Kenilworth case with 2 card frame, Centronics 737 printer, 10 inch monitor, and the

Gemini Dual Drive Floppy Disk System. The CPU and RAM boards are also available built - the additional cost is available on application.



GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M.

CP/M SYSTEM. The disk unit comes fully assembled complete with one or two 5 $\frac{1}{4}$ " drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and new N2MD PROM. All in a stylish enclosure.

Nascom-2 Single drive system. **£450 + VAT**
Nascom-2 Double drive system **£640 + VAT**
Nascom-1 Single drive system. **£460 + VAT**
Nascom-1 Double drive system **£650 + VAT**
Additional FD250 drives **£205 + VAT**

D-DOS SYSTEM. The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO.

Single drive system **£395 + VAT**
(please state which Nascom the unit is for)
Certain parts of the CP/M and D-DOS disk systems are available in kit form.
Details available on request.

KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case **£49.50 + VAT**
2-card support kit **£7.50 + VAT**
5-card support kit **£19.50 + VAT**

GEMINI EPROM BOARD

This Nasbus compatible EPROM board accepts up to 16, 2716 or 2708 EPROMs. It has a separate socket for the MK36271 8K BASIC ROM for the benefit of Nascom-1 users. And for Nascom-2 users, a wait state for slower EPROMs. The board also supports the Nascom Page Mode Scheme.

EPROM Board (kit) **£55 + VAT**
EPROM Board (built & tested) **£70 + VAT**

CASSETTE ENHANCING UNIT

The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232 handshake.

Castle Interface Unit **£17.50 + VAT**

A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels - all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO. Milham A-D Converter (built and tested) **£49.50 + VAT**

PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to be used with Nas-Sys 1 or 3. **Price £28 + VAT.**

DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. **Price (kit) £6.50 + VAT.**

NASCOM-2 Microcomputer Kit **£225 + VAT**
NASCOM-1 Microcomputer Kit **£125 + VAT**
Built & tested **£140 + VAT**
IMP Printer. Built & tested **£325 + VAT**

CENTRONICS 737 MICRO PRINTER

A high performance, low price, dot-matrix printer that runs at 80cps (proportional) and 50cps (monospaced). This new printer gives text processing quality print. And can print subscripts and superscripts. It has 3-way paper handling and parallel interface as standard. Serial interface is optional. **Price £425 + VAT.** Fanfold paper (2000 sheets) **£18 + VAT.**

GEMINI 'SUPERMUM'

12 x 8 piggy-back board for Nascom-1 offering five-slot motherboard, quality 5A power supply and reliable buffering with reset jump facility. **Kit Price £85 + VAT.**

BITS & PC's PCG

5 x 4 board which plugs straight into Nascom-2. Operates on cell structure of 128 dots, producing 64 different cells. Once defined, each cell may be placed anywhere, any number of times on screen simultaneously. Max screen capacity: 768 cells. Dot resolution: 384 x 256 = 98304. Many other features including intermixing of alpha-numeric characters and pixels. **Price (kit) £60 + VAT.**

GEMINI 64K RAM BOARD

Newly developed Nasbus compatible board that can accommodate up to 64K of RAM including Page Mode facility. **Kit Prices: £110 (16K), £130 (32K), £150 (48K), £170 (64K). Add VAT to all prices.**

All prices are correct at time of going to press and are effective 1st June 1981.

DISKPEN

The powerful text editor written for the Nascom is now available on a 5 $\frac{1}{4}$ inch floppy disk with a number of new features. **Price £43.25 + VAT.**

PORT PROBE

Allows monitoring of input and output of Nascom PIO. This board can generate interrupts and simulate handshake control. **Price (kit) £17.50 + VAT.**

HEX & CONTROL KEYPADS

Hexadecimal scratchpad keyboard kit for N1/2. **Price £34 + VAT.**
As above but including (on the same board) a control keypad kit to add N2 control keys to N1. **Price £40.50 + VAT.**

BASIC PROGRAMMER'S AID

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. **Price £13 + VAT.**

GEMINI EPROM-PROG.

2708 (multi-rail) and 2716 (single-rail) EPROM programmer kit controlled by N1/2 PIO. Supplied with comprehensive software for use with Nas-Sys. **Kit Price £29.50 + VAT.**

**WE STOCK
Nasbus
COMPATIBLE
COMPUTER
PRODUCTS**

All the products are available while stocks last from the Nascom dealers below.

(Mail order enquirers should telephone for delivery dates and post and packing costs.) Access & Barclaycard welcome.

BITS & PC'S
4 Westgate, Wetherby, W. Yorks.
Tel: (0937) 63774.

BUSINESS & LEISURE MICROCOMPUTERS
16 The Square, Kenilworth, Works.
Tel: (0926) 512127.

ELECTROVALUE LTD.
680 Burnage Lane, Burnage, Manchester M19 1NA.
Tel: (061) 432 4945.
28 St Judes, Englefield Green, Egham, Surrey TW20 0HB.
Tel: (0784) 33603. Tlx: 264475.

TARGET ELECTRONICS
16 Cherry Lane, Bristol BS1 3NG.
Tel: (0272) 421196.
INTERFACE COMPONENTS LTD.
Oakfield Corner, Sycamore Road, Amersham, Bucks.
Tel: (02403) 22307. Tlx: 837788.

HENRY'S RADIO
404 Edgware Road, London W2.
Tel: (01) 402 6822.
Tlx: 262284 (quote ref: 1400).



struggling for a strategic advantage. This is the part of the game for which an evaluation function will be of the greatest use. The players must fight for control of important squares, and in particular for control of the area near their opponent's king. In shogi the initiative is just as important as it is in chess, and by building up a strong attack in the area near the enemy king, a player may develop an initiative which can later be converted into a win. Many of the heuristics that you will find in *Shogi* magazine will relate to the initiative and to the concepts of king attack and king safety.

Perhaps the most difficult problem that you will encounter when writing a shogi program is that nobody has written one before you, so there is absolutely no published literature on the subject. In order to convert a shogi heuristic into a feature for your evaluation function you will therefore be compelled to make various guesses and estimates, and then improve the weightings of your function in the light of experience.

Possibly the most surprising aspect of shogi heuristics is the fact that there is no recognised scale of values for the pieces themselves. Almost every schoolboy knows that in chess a bishop or knight is worth roughly three pawns, a rook five pawns, and a queen nine pawns, but to the best of my knowledge there is nothing reliable in the shogi literature to compare. (Readers should be warned that in one book, published in English, the rook is said to be more valuable than the king — ignore this book and, probably, anything else not published by the Shogi Association.)

Those of you who have read my articles on chess will know that the second most important feature, after material, is mobility. In fact the chess pieces have material values which are not entirely disproportionate to their average mobilities, so it would be possible to write a chess program that was governed by present and potential mobility, rather than by material and present mobility. In shogi, since material values cannot be defined in the same way as they can in chess, mobility is possibly the most important feature. We define mobility in shogi in the same way as we do in chess — the number of squares attacked by a piece.

The attack on the enemy king is of greater importance in shogi than it is in chess. For this reason, two features which are employed in many chess programs are absolutely vital in a shogi program: King Attack and King Safety. A primitive measure for King Attack is found by adding 2 points for every attack on a square which is not more than three squares distant from the enemy king, and 1 point for every possible move to a square from which such an attack can be made. The sum of these attacks and potential attacks provides a measure of the extent to which a player's pieces can operate within the vicinity of the enemy king, and the extent to which they control possible flight squares that might be used by the enemy king to escape from a strong attack.

King Safety can best be measured by taking into account the number, nature and proximity of friendly pieces that are situated near the king. If your king is surrounded by many of its own pieces

it will be much safer from attack than if it is in an exposed part of the board, with few of its own pieces nearby. As in chess, it often pays in shogi to keep the pawns in front of your own king as defensive pieces, obstructing the attack of the advancing enemy. In addition, it is useful to have two or three generals (golds and silvers) near your king for added protection. The different shogi openings usually define a particular defensive formation for the king, so by reading about the openings you will learn the various defensive formations and you can design a feature for your evaluation function based on giving bonus points for having your own king well protected by the correct piece.

Gaining material in a game of shogi is useful for two reasons, and some method must be found to reflect this fact in your evaluation function. When you capture an enemy piece you deprive his king of a certain measure of protection — if the captured piece was near to the king this protection will be much greater than if the piece was many squares away from the king. You also have an extra piece 'in hand' which may be used later in the game to achieve some strategic aim or to expose the enemy king still further during the blistering attack which you launch prior to checkmate. One way in which your program can measure the value of a captured piece lies in the loss of mobility experienced by your opponent when you capture one of his pieces. Another way is simply to add a certain number of points for every piece that you hold in hand.

So far, we have discussed only a very small proportion of the total number of shogi principles, but these are among the most important. A computer program which takes into consideration mobility, king attack, king safety and the number of pieces held 'in hand' would be able to play a game better than the novice who has just learned the rules of the game. One very important aspect of shogi is the mating attack, and this is one area in which your program will be able to play better than many humans, because it requires pure calculation.

The mating attack

In shogi there is no endgame in the same sense as there is in chess. Because captured pieces can reappear on the board, it is rare for a shogi game to end when the board is almost completely devoid of material. To win at shogi you must launch a successful mating attack. We have already discussed two of the evaluation features which can help a program set up and develop an attack against the enemy king. The tactical phase that ends the game will often contain a long, forcing sequence of moves that is difficult for many human players to spot. A computer program should have no such problems, provided that it is looking along the correct path of the tree.

The answer lies in knowing when to search for a mating continuation, and in ignoring all other factors when looking for a mate. It is normally sufficient to have four of your own pieces attacking the enemy king area, so your mating routine can be triggered by a test which counts the number of your own pieces which impinge on any of the squares which are within (say) three squares of

the enemy king. If this test provides a positive result, the program can then look along all variations in which its own moves are checking moves. During this phase of the game all other moves may be ignored, on the assumption that if he is given a single move's respite, your opponent will be able to bring another piece to the defence of his king, or will move his king to a safer square. The routine which searches for mate should therefore be single-minded, and by ignoring all moves other than checks it ought to be able to search 7 or 9-ply deep, or even further. If no mate is found within some predetermined horizon, the program simply reverts to the middle-game search algorithm and looks for a move which improves its strategic control of the position.

How to deal with drops

As I mentioned earlier, one of the most serious problems in writing a strong shogi program is the very large branching factor caused by being able to drop a captured piece onto almost any vacant square on the board. (In fact you may drop onto any vacant square provided that (a) you are not dropping a pawn, lance or knight onto a square from which it will never be able to move; (b) you will not have two unpromoted pawns on the same file at the same time; and (c) you do not drop a pawn in such a way as to give checkmate on the move.) How can we reduce the branching factor without ignoring most of the better drops?

The answer lies in identifying a number of key vacant squares (say ten) and examining drops only onto those key squares. This can be accomplished by using the evaluation function to measure the improvement in score that could be achieved by dropping a hypothetical piece (a 'genie') onto each vacant square. The genie has the power of all the other pieces combined, and by estimating its effect on the mobility, king safety, king attack and other features of the evaluation function, when placed on each of the vacant squares, it is possible to produce a ranking order for the vacant squares which indicates which squares are the best candidates for drops. By reducing the number of such squares from (at least) 42 to ten, we can reduce the total number of moves which the program needs to consider. This is especially important when more than one type of piece is to be held in hand.

If a Shogi playing program is too difficult

It is, perhaps, daunting enough to the reader for me to suggest that you learn a new game as complex as shogi without my adding to this suggestion with the thought that you should also write a shogi-playing program. You may feel that the game itself requires enough of your time, and that a shogi-playing program might be beyond you, especially in view of the paucity of literature on shogi heuristics. In that case, there is still one programming exercise which you will definitely find worth your

while, as it will test your understanding of many of the tree-searching ideas that we have discussed in this series of articles, and it will stretch your ability to write code that executes efficiently.

Just as there are many people who are interested in chess problems ('White to Play and Mate in two Moves'), so there is even greater interest in shogi problems. An extremely interesting programming exercise can be found in writing a program which will search for checkmates. In the composition of a chess problem it is part of the composer's task that he must not allow a checking move to be the key to the solution. In shogi, the opposite is true — all moves in a shogi problem must be checks or replies to check.

A program which solves shogi problems must therefore employ an efficient test to determine whether or not a move is legal (ie, whether a reply to check achieves the aim of moving out of

check), and whether or not a move gives check. These two tests are sufficient, since a move which fails both tests is inadmissible in the tree search. Your problem-solving program has only a very small number of branches at each node, and so a deep search is possible without the program consuming enormous amounts of time. There is not too much scope within a problem-solving program for speeding up the search without the use of heuristics, but one or two notions do suggest themselves. Prefer a checking move that is near to the enemy king to one which is further away (reason — a far away move allows more interposing possibilities). Prefer a 'safe' checking move to a move which allows the free capture of material (reason — with more pieces of your own side on the board, you have greater chances of forcing mate). Prefer to evade check by moving the king than by interposing a piece (reason — an interposing move

may allow a free capture). Prefer to evade check by capturing the checking piece than by moving the king (reason — the less material your opponent has on the board, the harder it will be for him to force checkmate).

Of course, these rules of thumb all have very many exceptions, but other things being equal (which they never are) all of them have some value in ordering the search.

Bibliography

Fairbairn, J: *How to Play Shogi*.
Shogi Association: *Shogi* (magazine).

The reader is strongly warned against all other shogi literature published in any language other than Japanese. Up to the time of writing this article (May 1981) no other accurate literature is known, and errors in the rules and the moves of the pieces abound.

COMPETITION

Modern microcomputer technology has many applications, but one where it has so far had little impact is in reducing the problems of disability.

To mark the designation by the United Nations of 1981 as "The International Year of Disabled People", PCW, in conjunction with the IYDP Technology Working Group, is holding a competition for the best article on the subject:

"The application of micro-computer technology to the problems of disability".

There must be many possible applications for microtechnology in the fields of physical and sensory disabilities — remember, these include handicaps such as deafness, blindness, diabetes and epilepsy, as well as the more obvious physical impediments.

1st Prize

DAI PERSONAL COMPUTER

2nd Prize 3rd Prize
£100 £50

Articles of around 2500 words are invited, which can be either theoretical or a description of an actual application (with photographs, if possible), and which we will print in *PCW* later in the year. Entries will be judged by

PCW's Editor, David Tebbutt, Adrian V Stokes, Chairman of the IYDP Technology Working Group and Judith Hann, presenter of *Tomorrow's World* and science writer.

Please send your entry to IYDP Competition, 14 Rathbone Place, London W1P 1DE, enclosing a suitable SAE if you would like it returned.

**Personal
Computer**
World



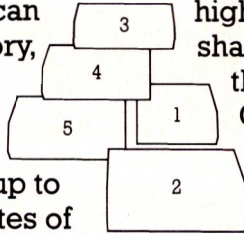
International Year of
Disabled People

Data Applications Ltd has kindly donated the first prize of a 48K personal computer worth £595. Plugging into the domestic TV, it provides sound, colour and high-resolution graphics. Sharp Electronics (UK) Ltd has kindly donated the third prize of £50.

The IYDP has requested an extension of the deadline for the competition to 31 July 1981. This is to help students fit their efforts around the academic curriculum.

BLACK BOX III MICROCOMPUTER SOLUTIONS

Conventional microcomputers can have problems – too little memory, not enough storage, poor communications, no expandability. RAIR's Black Box III range provides all the solutions. With up to 512K bytes of memory, 200M bytes of



high-speed hard disk, 16 simultaneous users, and shared-resource multi-computer networking, the only thing micro about the Black Box III is the price. Call your nearest Dealer for details.

- 1 Single mini-disk system 2 Dual mini-disk system
- 3 Single mini-disk plus 5" hard-disk system 4 Single 8" hard-disk system
- 5 Add-on 8" hard-disk



RAIR

Healey Office Equipment Unit 7, Westfield Industrial Estate, Portsmouth Road, Horndean, Hants Tel: 0705 597555
 Digitus Ltd 9 Macklin Street, Covent Garden, London WC2 Tel: 01-405 6761 Hallam Computer Systems Ltd 1 Berkeley Precinct,
 Eccleshall Road, Sheffield S11 8PN Tel: 0742 663125 Holdene Ltd Manchester Unity House, 11-12 Rampart Road, Leeds Tel: 0532 459459
 Lion Micro Computers Ltd 227 Tottenham Court Road, London W1 Tel: 01-636 9613 and 21 Bond St Brighton Tel: 0273 601838
 Micromedia Systems, Seymour House, 14-16 Chepstow Road, Newport, Gwent Tel: 0633 59276 NSC Computer Shops 29 Hanging Ditch,
 Manchester Tel: 061-832 2269 T & V Johnson (Microcomputers) Johnson House, 75-79 Park St Camberley Tel: 0276 20446 also
 148 Cowley Road, Oxford Tel: 0865 721461 and 48 Gloucester Road, Bristol BS7 8BH Tel: 0272 422061.

Rair Limited, 30-32 Neal Street, London WC2H 9PS Tel: 01-836 4663

THE WESTFARTHING SMALL BUSINESS SYSTEM

for Apple/ITT2020 Sharp micros

Designed from first principles for the family business, it will pay for itself by keeping the accounts in good order, saving management time on paperwork, and accountants' fees.

FUNCTIONS: (in short, everything you need)

- * Invoicing (+ discounts, quotations, delivery notes)
- * Customer accounts and shop sales
- * Bank and cash balances calculated weekly
- * Sales and overheads (30 categories) totalled weekly
- * VAT return calculated (while you have lunch)

SPECIAL FEATURES FOR OWNER - MANAGERS:

- * VAT - inclusive bills split automatically
- * Messages can be printed on invoices
- * Automatic payment entry when customer pays on the spot
- * Uses plain fanfold paper, prints your heading
- * Prints s/a customer address labels
- * User's manual (50 pages) in clear, non - technical style
- * Designed to be user - modifiable

Requires 48K RAM, Applesoft in ROM, 1 or 2 disc drives, printer. Program lives in core. Includes pages of program information, hundreds of REMs, disc map, etc.

Cost: £750 + VAT, includes setting-up assistance. User's manual £10. New program available, CAR SALESMANS SYSTEM £450 + VAT.



Westfarthing
Computer Services Ltd.
21 Wendron St. Helston. Cornwall.
Tel: Helston [03265] 4098.

Westwood Computers

117 TENNANT STREET, FIVE WAYS,
BIRMINGHAM

SEE OUR COMPREHENSIVE range of microcomputers for business and personal use!

WORDPROCESSING, ACCOUNTING, FINANCIAL MODELLING. We give full software and technical support.

The **APPLE II** — many programs, accessories, graphics, etc.

The **CIFER 2684** microcomputer — Excellent CP/M computer with ability to interface with mainframes. POWERFUL WORDPROCESSING program available with macro programming facilities.

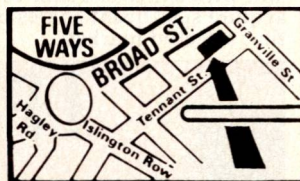
The **Z PLUS** microcomputer range — Extends to 20MB hard disk multi-user system. CP/M, S100 bus.

MATRIX PRINTERS: SEIKOSHA GP80, MPI, CENTRONICS 737, LEAR SIEGLER, ANADIX 9500. **DAISYWHEELS:** OLYMPIA SCRIPTA, DIABLO 630.

We have an extensive range of **COMPUTER BOOKS, APPLE PROGRAMS**, and are distributors for **SCOTCH DISCS** and **TAPES**.

VISIT OUR SHOWROOMS!

CONTINUOUS DEMONSTRATIONS — BROWSERS WELCOME!



021 632 5824

On the street parking always available.

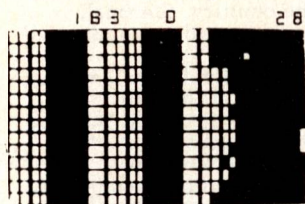


Acorn Atom

**ACORNSOFT
APPROVED**

**SOFTWARE
on cassette**

**ACORNSOFT
APPROVED**



BREAKOUT

4K, m/c, sound gr.mode1 - now only £4.00



INVADERS!

12K, m/c, sound gr.mode4 - now only £8.00

PINBALL 6K, m/c, sound, gr.mode2 - now only £4.50 **SEND SAE FOR FULL CATALOGUE**

Sinclair ZX81

ZX81 SOFTWARE (AND 8K ROM ZX80)

Low price software for the ZX81 and ZX80 with 8K ROM - send SAE for latest list
ZXAS MACHINE CODE ASSEMBLER
FOR 16K ZX81 & ZX80 (4K & 8K ROM) - Supplied on cassette with full documentation
A MUST FOR THE SERIOUS ZX80 & ZX81 USER £4.00

ZX80 SOFTWARE PRICES CUT!

ZX80 PROGRAMMING COURSE - Book & cassette of programs
BREAKOUT 4K, m/c, moving graphics

Send SAE for full catalogue.

£8.95 £6.50
£6.00 £4.00

ALL PRICES INCLUSIVE. FAST DELIVERY. MAIL ORDER ONLY. WE ARE LOOKING FOR HIGH QUALITY SOFTWARE FOR THE ATOM & ZX81 - TOP RATES PAID - SEND SAE FOR FURTHER DETAILS.

BUG-BYTE

251 HENLEY ROAD COVENTRY CV2 1BX

£1199!

ITT 2020 SYSTEM

COMPRISING:-

**48K COMPUTER
DUAL DISK DRIVES
12" GREEN MONITOR
PALSOFT & AUTO START ROMS**

Equipment is brand new. Boxed & Guaranteed for 12 months.

Please send payment with order of £1393.85 (includes VAT & securicor delivery). Allow up to 28 days delivery.

ELFTON LTD

(0429) 61770

ADVANCE CHAMBERS
SURTEES STREET
HARTLEPOOL
CLEVELAND

AUTHORISED APPLE, COMMODORE & ITT DEALERS

BANKS' STATEMENT

NIP IN THE AIR

This month we're pleased to introduce Martin Banks, who'll be giving us a monthly overview of the micro world.

I was sitting in the kitchen earlier today (I am writing this quite late at night as it happens — which it usually does). From where I was sitting I could see a wondrous panorama of that jewel of English architecture, Luton. Watching a beautiful sunset of blues and reds that followed on a day when it had rained, blown a gale and done most of those things that are generally uncondusive to thinking wonderful thoughts, it occurred to me that there was some form of symbolic parallel between the weather and the UK microsystems industry. Then I thought that perhaps I was taking the idea a little too far — you know what I mean, the industry being damp, full of wind and quietly fizzling out in a well stage-managed and terribly dignified demise.

I decided in the end that I was right but not completely so; some of the original symbolism hung together somewhere and so I thought about it some more. And then... and then. It came back to me. Over recent weeks several events have occurred in and around the industry that have changed the longer-term perspectives on the micro scene and changed them not just in good old Blighty but throughout the world.

The things? One is the Japanese presence; another is the position of the existing major computer manufacturers; another is the existence or not of a new consumer market and products to fill it. Each and any of these would have a significant impact on the shape and feel of the micro world. Put them together, however, and the changes are likely to be fundamental, long term and very painful for some people and companies.

But for whom, I hear you ask, will they be painful? Well, I'll tell you. The people and companies that are likely to suffer most are the very companies that began the whole business in the first place — the Commodores, Apples, Tandys, Cromemcos, etc, etc, which manufacture the hardware that the dealers and retailers sell in this country. They are the ones in danger of suffering the glowing sunset of dignified demise. And there is evidence to suggest that part of the reason will be the fact that elements of the distribution chain essential to their success — the dealers and retailers — appear to think they are full of the symbolic water and wind.

Let's start by looking at the Japanese and the effect they are likely to have. For reasons that are much too long, complicated and contentious to go into here, Japanese industry has been able to organise coherent and cohesive plans for targeting selected market areas, developing well-engineered products suitable for the market and then manufacturing them and marketing them in sufficient volume and with sufficient skill to acquire significant shares of that selected market.

ducts but also having the distribution networks. Here, the Japanese have a distinct advantage over the American and European manufacturers. Through the way they have taken over the consumer electronics marketplace, they have learned all the good and bad points of running a distribution network. They now seem intent on using that knowledge to the full in the micro business — and many dealers can hardly wait.

Dealers are naturally reluctant to be quoted on

dump their US suppliers when the Japanese got going properly and waxed lyrical about such items as support and reliability. Several dealers talked about the 'paternal' attitude of the Japanese towards them, about the Japanese wanting to work in partnership. Closer to reality, they also mentioned the better margins on sales that the Japanese provided, allowing the dealers themselves to offer better support to the customer.

A measure of the expectations held out for the Japanese by the dealers is the fact that all were convinced that a Japanese company will be number one supplier in the UK within two years. This against a background of unanimous agreement that none of the Japanese are yet ready or in a position to assume that mantle.

The current leading contender in the UK is Sharp, with its MZ-80K, selling at the rate of around 500 a month and climbing. This is being followed to market by the 3201 business system and the MZ-80B scientific system. Sharp's manager, Paul Streeter, who concurs with the generally held view of the company's fourth position in the UK marketshare rankings, says that this has been achieved with a system not suited to the main growth market in the country, the small business and 'occupational' sector.

'The keyboard is wrong,' he says of the '80K, 'and until we got CP/M running there wasn't much of the right software.' With the new 3201 he hopes to have this last fault corrected. The provision of suitable software is seen by everyone as the one factor holding back the Japanese rush. And though Sharp is currently the leading contender, there are and will be others. There are some smaller Japanese companies already pitching in the market and the likes of NEC and Matsushita are preparing to jump in.

Bob Gleadow, UK general manager at Commodore, doesn't feel they will go for the business market, preferring to wait for the emergence of the consumer market proper. He also states that they have been able to take advantage of the market development work put in by the American companies. 'They have learned from our mistakes in the market,' he says, 'but we are capable of operating at their standards of products and support.



One of the contenders: Oki's BMC if 800

Japanese companies have done this in shipbuilding, motor manufacturing, consumer electronics and semiconductors. They are also doing it in computers, starting at the mainframe end with kit that is plug-compatible with IBM and then working down.

Having seen the growth in the market for micro-computer systems, the Japanese are now ready to move in in a big way. To do this, of course, means not only having the right pro-

their views but rebellion against the dominant US manufacturers is growing in their ranks and fond eyes are being turned Eastward. 'We welcome them with open arms', one said to me. 'They trade differently. They don't want to put you out of business.' He went on to say that Japanese suppliers could easily make dealers change their current allegiances on the question of suppliers.

Another said he knew of several who would probably

The marketplace demands an increase in support in many areas.'

Despite this, Sharp's new 3201 and NEC's 8000 series machines show that the Japanese want a share of the business market as well as the consumer one. The American manufacturers are in for a tough fight and it looks as if they may not be able to count on too much support from their dealers.

The question of dealers and distribution brings me to the second point: the position of the existing computer manufacturers. Companies like IBM, Digital Equipment and Xerox have quietly sat on the sidelines watching the cut and thrust of the micro market and watched it develop from the non-important area of funsters and hobbyists into a big money operation that is beginning to take market-share away from them. As one Digital Equipment supplier in this country put it to me recently: 'I visited a small company the other day that was running invoicing on a PET and it worked.'

All three companies are now dabbling in the distribution end of the business, opening retail outlets at least in part to learn the rules of the game. It can be assumed that they will be tolerably quick learners and it can be taken as a certainty that they will have suitable

products. Take IBM, for example. The company, and I quote, 'never speculates on future developments' but it now has two shops in the UK, has been playing with its own personal computer system for around two years and has been talking to Matsushita in Japan about buying a small system from them. Take DEC; it has been working for over two years on a single-chip LSI-11 processor.

'IBM has been talking to Matsushita in Japan ...'

With companies like these it is not so much a case of them becoming like horse-drawn coaches — superseded by events — even though there are several industry observers who contend that this is possibly the case. Instead, it is more likely to be a case of waiting to see how things develop in the marketplace and then being ready to make a move. I am not suggesting that once they do make their moves, these companies will have a divine right to the micro-market (if no-one else does, the Japanese will ensure that) but only a fool would undervalue their chances.

BANKS' STATEMENT NIP IN THE AIR

The third point is the consumer market — whether it exists and what products will serve it. One man who feels the time may be right to test the water is HB Computers director Mike Hambly, who has decided to set up the aptly-named Computer Supermarket in Corby, Northants. He is aware of the gamble he is taking, saying quite blithely: 'In two years time I will be a millionaire, or have fallen flat on my face.' The gamble is, in fact, two-fold, for not only is he taking on the trials and tribulations of setting up a new company in a business noted for its fatalities but he is setting out to create a sector of the market that has palpably failed to materialise so far.

The consumer sector represents, at best, only ten per cent of the marketplace, and the general frailty of user users when it comes to subjects like software has effectively blocked concerted attempts to merchandise micros.

This situation will certainly change in time and there are signs that the changes are on the horizon —

speech I/O, expensive use of firmware, use of the public telephone system, etc — and some of them are now beginning to appear, or at least be talked about with some certainty. Then, the consumer micro market will be as significant as the pocket calculator was ten years ago. I cannot say with any confidence that I feel it has happened yet.

One thing is certain, however. When it does occur, it is likely to be the Japanese companies that come up with the goods.

Put all these points together and it becomes possible to see why I suggest that changes are round the corner. The changes are both in the products themselves and the mix of companies that manufacture them. The small companies that started this business have had to struggle to get going, and some have become tolerably large companies in succeeding. By succeeding, however, they have also started to tread on some painful corns. Some will survive but they won't all be Davids against the Goliaths.

PIG IN A POKE GOING CHEAP!

Look at it this way:
No-one in their right mind would go out and spend £5000 on a motor car without first satisfying himself of its reliability, and overall value for money.

Likewise with hi-fi.

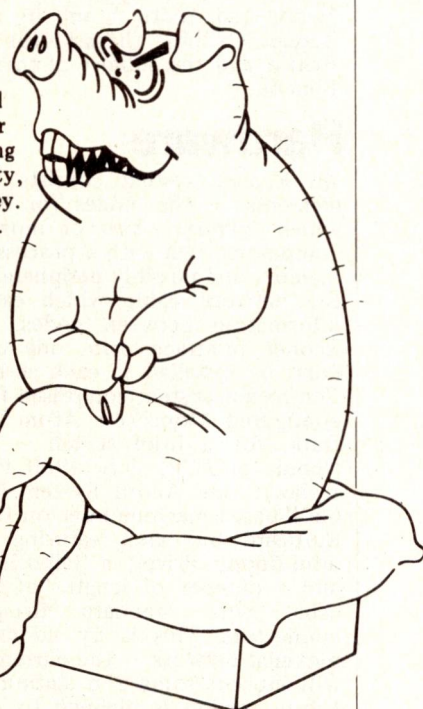
Whether you're planning to invest several thousand pounds, or you simply need a cheap set of headphones, some products are bound to be superior to others, and mistakes can be expensive. The Hi-Fi Choice range is specifically designed to eliminate this element of chance.

We can't make your mind up for you. But we can provide the type of information that will help you decide for yourself. Alternatively, you could always buy a pig in a poke...

The Choice is yours.

HI-FI CHOICE

Simply a better way of buying hi-fi.



Please send me the following copies of Hi-Fi Choice. Add 40p p&p for each issue. (Overseas postage 60p)
 ___ copies of Loudspeakers @ £2.00 ___ copies of Turntables and Tone Arms @ £2.00
 ___ copies of Systems @ £2.00 ___ copies of Cartridges & Headphones @ £2.00
 ___ copies of Cassette Decks & Tapes @ £2.00 ___ copies of Receivers Tuners & Amplifiers @ £2.00
 ___ Hi-Fi Choice Binders (holds a complete set) @ £1.95 (incl p&p)

Name _____ Address _____

PCW4

I enclose a cheque/P.O. for £_____ payable to Sportscene Publishers Ltd. Allow 3 weeks for delivery. Mail coupon to Hi-Fi Choice Offer, 14 Rathbone Place, London W1P 1DE. If you do not wish to clip this coupon please send your order, clearly printed, together with your remittance to the above address.

ACORN ECONET

BENCH TEST

Everybody is talking about Acorn Computers Ltd, most of the interest being focussed on the BBC's choice of Acorn to supply a machine around which to base its first consumer computer series. This has generated a wide range of comment in the press, particularly in connection with the eccentricity of Acorn's Basic dialect. The second interesting event has been the announcement of Econet, which appears to offer multi-user computing at an incredible and unprecedented low cost.

The idea behind this network scheme isn't new — you start with a small, cheap, stand-alone microcomputer and arrange for several of these to be linked to something which lets them access a common disk system, a printer or any other expensive or esoteric peripheral which it may require occasionally but not continuously. In this way a collection of PETs can be clustered by means of the Mupet, Apples by means of Nestar and Acorn Atoms by means of Econet. Of these, the last is the cheapest, British and the subject of this month's Benchtest.

Hardware

An Econet system consists of three elements — the nodes (or 'stations') which comprise two or more microcomputers, each with a processor, some memory and possibly peripheral devices; the network cable which carries the information between nodes; and the Econet interface card, one of which must be installed in each active node. The review system comprised four fully configured Atoms (c f, Atom Technical Data, for a brief sketch — or Mike Dennis in PCW, July 1980 for a full review); one Acorn System Three (a 6502-based machine built on the Acorn Eurocard bus and featuring a single mini-floppy drive); a Seikosha printer and a number of lengths of four-way cable with standard five-pin din connectors. This is by no means the maximal network — the current Econet will support some 255 stations while a future version is planned to cater for 64k nodes organised as a hierarchy of up to 255 local networks, each comprising up to 255 stations.

Each station has a unique address which is hard-wired into the interface card. Stations number 255 and 235 are respectively designated the File Station and the Print Station. This is because if these facilities are required on the network (and it is reasonable to expect that they would be) then each of the microcomputers located at these nodes must

*Sue Eisenbach and Chris Sadler
continue our series of Multi-user
Benchtests with a low-cost
British system.*

be dedicated to the running of a program called the File Server and the Print Server respectively. On the review machine, for example, the File Station uses the Acorn System Three with its floppy disk but the printer was attached to one of the Atoms which had, consequently, to be sacrificed (as a user station) every time a print-out was required. The next revision of the network software (to be apparently written in machine code, rather than in Basic as is the current one) is expected to offer sufficient flexibility to allow several File and/or Print stations on the same network. However, there are no plans to combine these two functions into a single node (an obvious saving), nor to offer hard-disk facilities.

The Econet interface card comes in two versions: one for the Atom, plugging into the top (ie, wrong) side of the PCB — a thin strip of board right above the keyboard; the other for the Acorn (Systems Two, Three, Four or Five) — a Eurocard which slots directly into the Acorn bus. Both require a 4k machine code program starting at A000H and, at least in the case of the Atom, is stored in ROM. The Econet software is boot strapped into the local processor on power-up or when < BREAK > is pressed.

In the design of a network, it is necessary to define how the information to be transmitted on the network is to be made up (often called the 'packet'); how it is to be transmitted and how all the traffic on the network is to be regulated. On the Econet, much of this work is handled by the Motorola MC 6584 ADLC (Advanced Data Link Controller) which is housed on every interface card. When one station wants to send a message to another, its Econet software will structure the body of the message into one or more packets which are passed onto the ADLC. Each packet contains source and destination identification codes (one byte each), a one-byte 'port-number' which serves to identify the nature of the message (eg, a command or a piece of data, etc) and the information itself. The ADLC then constructs a 'bit-frame' which contains

the packet suitably converted into a serial data-stream, enclosed by start and stop bytes (otherwise known as open and close flags) and a 16-bit CRC (cyclic redundancy check) — see diagram. Obviously, on reception of such a bit frame from the network the ADLC will strip off the extra bits and reformat the messages as parallel data which it puts on the local processor's bus.

Before it can transmit a packet, it is necessary for the ADLC to determine the state of activity on the network. An idle state will be seen by the ADLC as a stream of logic 1s (at least 15 bits long) whereas in a busy state (ie, another ADLC transmitting somewhere) logic 0s will have been inserted into the bit stream (Zero Bit Insertion). Thus, each ADLC can 'listen' to the network and will only transmit when the network is free.

However, this does not deal with the 'collision' problem when two ADLCs hear nothing on the network and begin transmitting simultaneously. Should this occur, the information actually on the network becomes corrupted, a circumstance detected by both transmitting stations which listen to their own transmission. These will then back off until the network is clear again. In order to prevent this from happening over and over again, each station generates a unique 'arbitration code'. As soon as the colliding stations have backed off, they rotate their arbitration codes and interrogate the top bit. Depending on its value, they either return to listening or try to retransmit. Since the two arbitration codes are different, eventually one will get the opportunity to transmit without interference. In fact, each arbitration code is made up of eight 1s and eight 0s so that any station has a 50-50 chance of going first following any collision. This is also probably necessary to conserve uniqueness under rotation — it will be interesting to see how Acorn copes with arbitrating among its proposed 64k stations. Assuming that a station manages a successful transmission, it first sends a 'scout' message (the first few bytes of the packet) and only transmits the remainder when the receiving station has acknowledged and indicated its willingness or ability to receive the frame. During the entire transaction the two participating stations have complete control of the network and any other station wanting to transmit would find the network in a busy state.

Physically, the network cable consists of two twisted pairs — one for data transmission and the other for



clock signals (in both directions). For short networks, shielding is not necessary, although it is recommended for longer runs. Any configuration is possible (provided there are no loops), although a straight-line hook-up is recommended for larger networks since the signal deteriorates over spurs and branches. Branch connectors are such that the electrical continuity of the network is not dependent on whether or not any individual node is switched on. (Incidentally, neither the Acorn nor the Atom appear to have on/off switches anywhere on the casing.) The clock signals are generated by one station, designated the 'master-station'. (Jumpers exist to configure any Econet interface card to perform this function.) These are used to synchronise data transfer. The clock frequency recommended by Acorn depends on the size of the network. The review system was rated at 250 kHz which would have been good up to 300 m. For networks up to 1.7 km (sounds suspiciously close to a mile), 107 kHz was recommended.

Talking of recommendations, Chris Curry of Acorn Computers felt that a typical Econet configuration will probably consist of as many Atoms as required (fully expanded) and probably an Acorn System Five as the File Station. This has two (Tandem) double-tracked, double sided minifloppies (800 kbytes disk storage) and probably 24k of RAM. Since this is the top-of-the-line in file servers, this works out a bit more expensive than the Econet might appear at first sight.

Software

There are several different parts to the software available on the Econet. Firstly there is the Econet interface program installed in 4k of ROM in each station. This features the network operating

system (NOS) together with its low-level primitives. The latter consist of six routines used in the construction of the high-level NOS commands (see later) and are available to programmers at assembler language level. TRANSMIT and RECEIVE are the lowest level and have obvious functions, while PEEK and POKE have their normal meanings except they act on another user's memory (this network is the ideal environment for the programmer who is also a busybody!). RESET and START are even worse — RESET tells a distant station to stop what it is doing and wait for a START instruction (so that its memory can be examined/altered in peace), while START itself passes a memory address to the waiting station and causes it to begin execution there.

The high-level commands under NOS can be used in immediate mode or embedded in Basic programs. Some are inherited from Acorn's Cassette and Disk Operating Systems (COS and DOS respectively). These are *SAVE; *LOAD; *CAT(alogue) and *DELETE. The * serves to designate these as NOS commands rather than commands to the resident Basic system (eg, LIST, RUN, etc). Other commands deal with specific network functions so that *VIEW n provides the user with a snap-shot of station n's screen.

Continuous 'viewing' can be achieved by 10 *VIEW 3 (for instance)
20 GOTO 10
RUN.

However, this viewing can never be entirely surreptitious since the victim's screen 'snows' slightly during each snapshot and the continuous interruptions slow down processing discernably.

Similarly, the command *REMOTE n will allow the user of a local station (not n) to take over station n (the remote station) entirely. Commands typed into the local keyboard will

appear on both screens but will only be obeyed by the remote processor. On the other hand, the remote keyboard is disabled (except for break). So this is what you can do — type *REMOTE 3 (say) and take over station 3. You can load a program into memory, begin execution and the memory on your system will be unaffected. Meanwhile, the user at station 3 just sits helplessly watching. Unfortunately, when graphics mode is used, the signal does not get back to the local screen. Since *VIEW can transfer graphics signals across the network, we assume this is a bug in *REMOTE. While in remote mode, the remote station can be reset by typing 0 and remote mode itself can be disabled by the command *ROFF. The documentation mentions a further command, *NOTIFY n, which is intended to send a message to the screen of station n (or broadcast to all stations if n=0) — but we couldn't get it to work.

Finally, the printer station is accessed from another station by typing ^B (must be followed by 'delete' due to a bug in the current software) and disabled by ^C. The effect is the same as ^P under CP/M in that anything appearing on the screen will be reproduced at the printer. That completes the range of commands recognised by the NOS. They are simple to use and appear to be reasonably efficient, if a little limited. The network error messages are clear and worth mentioning:

NOT LISTENING: station referenced is switched off

NO REPLY: fault during transmission

BUSY: peripheral in use

TIME OUT: peripheral not used for extended period (eg 15 secs) so link between station and printer severed

NO! FILE SERVER: attempt to *REMOTE the file station.

The second part of the network software consists of the peripheral utilities. These are called 'servers', so there is a 'file server' and a 'print server'. Both of these programs have to be executed on the processors at the relevant stations before the network is ready for use. The file server must run at station 255. Every time a file is referenced by another station (ie, **SAVED** or **LOADed**) an entry is made on the file server screen. This consists of the name of the file and other information like its location on the diskette, etc. When the file server is booted in, every station on the network is made known to the file server by a program known as **BOOT**. A 'qualifier' can be associated with each station — presumably this will be used in future versions to define the status or privilege of users on that station, in so far as this status affects access to disk-files. Likewise, the literature mentions a number of commands covering file operations (including random access), directory operations, and disk operations, including defining and altering public and private access rights. Our file server, however, could only **LOAD** and **SAVE** Basic programs or ***LOAD** and ***SAVE** small (less than 20 kbytes) chunks of memory. The file server runs on an Acorn System 3, 4 or 5.

The print server on the other hand runs on an ordinary Atom to which a printer is attached at station number 235. When another station types **B** at command level (or **\$2** in a Basic **PRINT** statement), it gets control of the printer station until **^C** (or **\$3** in a Basic **PRINT** statement) is typed or until there is no transmission for several seconds, after which the print server will disengage itself and type **'TIME OUT'** on both the printer and the attached station. Should any other station try to get the printer while it is engaged, a **'BUSY'** message will be received and the user will have to try again later.

The third software element includes user utilities and language translators. At the moment all that is offered in this department is Acorn's Basic with Assembler which is supplied in ROM on all Atom stations and on disk in the file station. For those readers who cannot remember Mike Dennis's fairly extensive coverage of this dialect, here is a list of the more idiosyncratic highlights, both good and bad points:

1. 32-bit precision integers named **A, B, . . . X, Y, Z** (ie, only 27 allowed).
2. Floating point variables and strings designated by non-alphanumeric prefixes (eg, **\$** for strings, etc). Arrays referenced by double character variable names (eg, **AA**).
3. The prefix **'?** has the effect of a **PEEK** or a **POKE** depending on the context.
4. The **PRINT** statement does not automatically append a **<CR>** — this must be done explicitly.
5. The construct **DO <statement> UNTIL <condition>** is supported.
6. The command **LINK** can be used to enable the incorporation of assembler mnemonics directly into the Basic source. (This is how the NOS primitives can be utilised in programs.)

Finally, under NOS it is not at present possible to create or access data files except as chunks of memory refer-

enced by starting address and length.

While we had the Econet, we had the opportunity to preview Acorn's new Pascal. This has not yet been released and is currently missing some features which it will need before it can be regarded as fully viable. We received a letter from its creator, Paul Farrel, telling us as much and asking us not to Benchmark it as all the debugging statements were still in. A fuller description of the language itself will be given in a future article but we cannot resist publishing our Benchmarks (floating point tests excluded — not yet implemented); they make quite interesting reading when compared to other 6502 Pascals.

A Pascal compiler would be a very definite boon to the Econet system but the snag seems to be that part of the compiler's address space overlaps the Econet interface program's space so

implemented and proved satisfactory, before committing themselves to the Econet.

For the NOS:

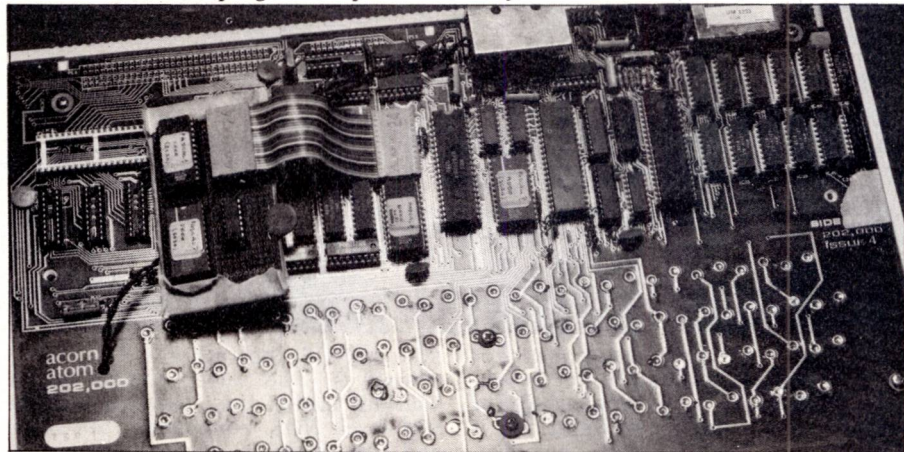
1. Some means of restricting availability of powerful network commands to 'privileged' stations;
2. Wider range of high level commands providing easier access to NOS primitives;
3. Provision for more than one file or printer station on the system and amalgamation of file and print stations;
4. Pascal.

For the File Server:

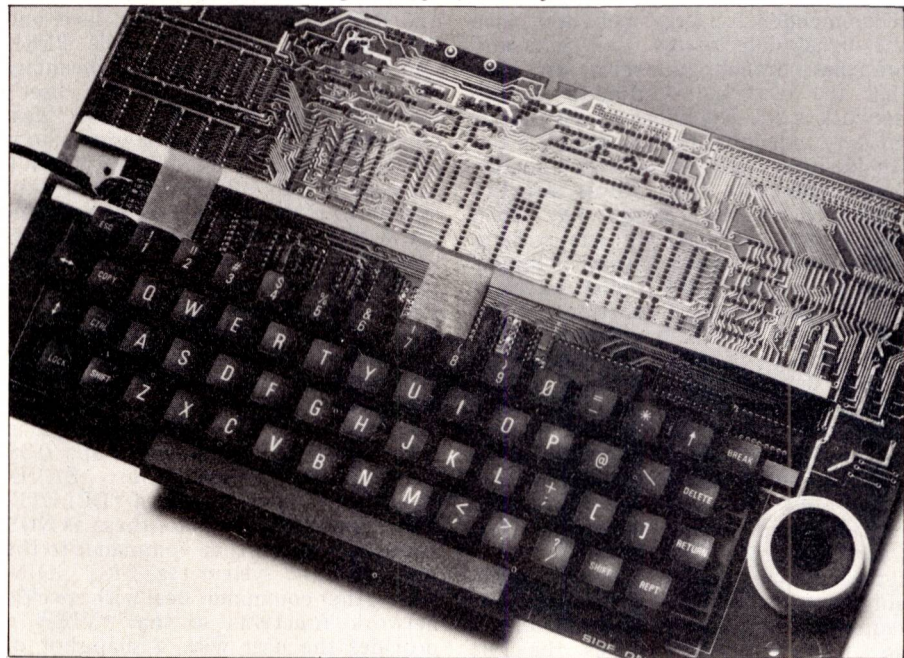
1. A simple yet robust security system for user files;
2. Provision for data-file manipulation within programs;
3. Provision for hard-disk or other massive file-store.

For the Print Server:

Implementation of a spooling system



The Econet controller fits along the top of the keyboard.



The extra board to the left replaces the Basic ROM to provide Pascal.

with the current design this can never be. Perhaps future configurations will support a disk-resident relocatable Pascal which can be down-loaded onto individual stations.

In conclusion, we found that the Econet seemed to have very promising potential as the basis of a low-cost network but feel that interested readers should wait until the following enhancements and extensions (some under development or mentioned in the specification, some not) have been

whereby output from different users is temporarily stored on a disk and queued to the printer when it becomes free.

Benchmarks

The multi-user Benchmarks take on a different shape when run on a network. For instance, the test designed to tie up a single processor will not show any effects when each user has a processor. On the other hand the file accessing tests are crucial and here, unfortunately,

For 80 Column Printers call Micro Peripherals

SEIKOSHA GP80

Probably the world's most compact 80 column Impact Printer

*5x7 dot matrix *128 chr set inc £ sign *High Res Graphics *30 CPS *80 chrs /line or extended chrs *12 chrs per inch *Tractor feed *Up to 8" plain paper with 3 copies *17.25d x 32.8w x 13.2h cms *2.5Kg



Dealer Special

SEIKOSHA GP80 (inc. 2000 sheets of paper) £199*

EPSON MX70

The lowest cost 80 CPS Printer with High Resolution Graphics

*5x7 dot matrix *80 CPS uni-directional *96 chr set inc £ sign *High Resolution Graphics (8x480 dots/line) *80 chrs/line or extended *Adjustable Tractor Feed *4" to 10" paper with up to 3 copies *Easy head replacement. Ideal for Acorn, Apple, Nascom etc.



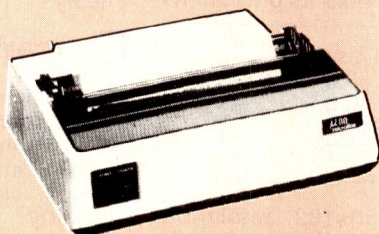
Dealer Special

EPSON MX70 £259*
Friction Modification Kit £call

OKI MICROLINE 80

TRS-80 Graphics compatability

*9x7 dot matrix *80CPS uni-directional *80 col. or condensed *Expanded characters *Friction and pin feed *Up to 3 copies

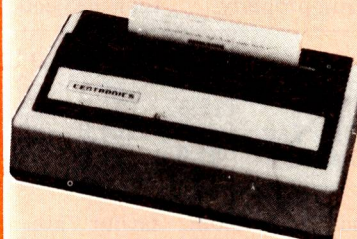


OKIDATA MICROLINE 80 £299*

CENTRONICS 737P

High quality proportional text suitable for word processing type applications.

*80 CPS proportional mode *50 CPS mono spaced mode *Nx9 (proportional or 7x8 (monospaced) matrix *96 character set *9½" pin feed or friction *Reverse platen



CENTRONICS 737 £349*

EPSON MX80

Correspondence quality hardcopy at a realistic price

*9x9 matrix with true descenders *80 CPS bi-directional with logic seeking *80 column with condensed and enlarged characters giving 40, 66, 80 and 132 chrs/line *Tractor feed *Optional interfaces for APPLE, PET, TRS80, VIDEO GENIE, SHARP RS232



Dealer Special

EPSON MX80T. £call
Friction Modification Kit £call
Interfaces £call

EPSON MX80F/T-1 MX80 F/T-2

This must be the first choice for a truly professional 80 col. printer

*9x9 matrix with true descenders *Friction and Tractor *12 different fonts *40, 66, 80 + 132 column *Single sheet feeding *96 chr set inc 4 Int chrs



Dealer Special

EPSON MX80 F/T TYPE 1 £call
EPSON MX80 F/T TYPE 2 £call
Ideal for Apple, PET, Acorn, Interfaces £call
TRS80, Sharp etc. Paper Roll Holder £call



EPSON MX82

High Resolution Graphics with 'high gearing'

*9x9 matrix with descenders *Details as MX80T/1 but with high geared high resolution graphics (1152 dots/line)



Dealer Special

EPSON MX82 £389*

OKI MICROLINE 80	£299*
EPSON MX80T	£call
EPSON MX82	£389*
EPSON MX85	£call
EPSON MX100	£575*
ANACOM 150	£699*
QANTEX 6000 P/S	£call
PAPER TIGER 560 G	£995*
ANADEx 9501	£call
VISTA-TEC (P)	£950*

FOR ALL YOUR PRINTER NEEDS CALL 0256 56468

we were not able to test as fully as we would have liked. There are two disk tests, each designed to transfer 100 128-byte records to and from the disk. In the first test, the file should be opened and closed before and after each write and read, while in the second test the file is opened for 100 writes, then closed, then opened for 100 reads before finally being closed again.

Since the Econet would not allow data files to be accessed from within a program we had to be content with transferring chunks of memory onto the disk and retrieving them. Since each such transfer involves opening and closing a file we took this activity to be roughly equivalent to the first of the tests described above (ie, the 'short record' disk test). For the second test, we would have like to transfer 12,800 bytes in one go but this proved too much for the file server so we were reduced to transferring 1280 bytes ten times. This gave reductions in timing of the order of one quarter, so, extrapolating, one could expect improvements of a factor of one quarter again for the full disk test. However, there will have to be considerable changes in the software before these tests can be run properly.

M-U Benchmarks

	1 User	2 Users	3 Users	4 Users
Processor Test	33.2	33.4	33.4	33.3
I/O Test	119.5	120.1	119.7	120.0
Short Record Disk Test	161.4	321.8	482.7	643.2
Long Record Disk Test	37.9	71.2	107.3	137.7

Finally, as promised, the Atom Pascal Benchmark figures:

magnifier	2.4
forloop	31.3
whileloop	80.7
repeatloop	71.0
literalassign	47.7
memoryaccess	46.8
realarithmetric	—
realalgebra	—
vector	126.1
equalif	86.0
unequalif	83.4
noparameters	13.4
value	33.0
reference	27.4
maths	—

Potential

Acorn bills the Econet as a 'low-cost local computer networking system for schools, business and laboratories'. Firstly, let it be said that the system certainly is low-cost but, owing to the unbundling (literally) of chunks of essential hardware, it is not as low-cost as it might seem. For instance, you've probably seen the Atom advertised at £120 but you've still got to get hold of a (separate) power supply and monitor (total price £142) before you could get it up and running. Or you could make do with a domestic television.

Bearing this in mind, each station on the Econet therefore consists of three boxes (computer with keyboard, monitor, power supply) plus interconnecting wiring, plus network cable — so anyone planning an installation should consider building in this wiring (and installing on/off switches nearby).

Despite this, on a cost per machine basis, the Econet appears to be an attractive proposition for schools — this view has been endorsed by the DOI.

Schools need to provide systems for pupils to learn programming on and to run CAL software on. For the former, an Econet system could be a slightly dubious solution. Firstly, a multi-user system in a school environment must be reasonably secure, and the File Server available for review purposes offered no security. The thought of 20 pupils each on their own machine but each with the capability of deleting and altering everyone else's files and memory, as well as the ability to disable keyboards at will, would deter all teachers save those who take particular delight in anarchic chaos (or strict disciplinarians.) In fairness, however, Acorn has promised a more secure system. Secondly, there is only a very limited choice of languages available on Econet stations. A strange dialect of Basic and Assembler may not be everyone's idea of the ideal teaching machine. (The Pascal and Econet software occupy the same address space, so cannot be used together.) Finally, the Atom in particular (that is, the 'cheap' solution) has space in its case for a maximum of 12k and this may not be sufficient for A-level pupils to write their projects on. Besides its price, in its

favour are the 250x192 resolution graphics, sound and interfacing capabilities useful for CAL and other computer applications. However, there is a dearth of quality software around to exploit these capabilities.

It is hard to see the Econet, as it stands, fitting into a business environment, where there is a need for robust hardware (and lots of it — eg, hard disks), robust software (and lots of it, such as ledgers, financial planning packages, databases, word processing stuff) and good file security. However, Chris Curry did mention that independent micro firms were developing software to connect several major micros into the Econet (Apple, PET, Research Machines 380Z) which may carry the type of software which business users expect to have. However, there is some doubt that CP/M will perform quickly enough to satisfy the Econet's protocol.

The laboratory user is probably Acorn's longest established type of customer and it is probably in the labs that the Econet will fit with the least trouble. The Acorn systems provide a wide range of extremely useful cards and even the Atom comes with a Versatile Interface Adaptor option. Also, laboratories are accustomed to having cables and connectors leading hither and thither and a cheap, easy-to-use network could prove an excellent and efficient way of collecting, manipulating and storing lab data. The Basic, although eccentric for teaching programming, seems well-suited to lab applications.

Documentation

The (prototype) Econet system which we reviewed was supplied with a spiral-bound 'Atomic Theory and Practice', covering Basic and Assembler for the

Atom, together with several typescripts including 'Econet Version I — User Manual'; 'Acorn (Econet) Technical Manual'; 'Acorn DOS Manual' and a long document entitled 'Atomic Network Operation' which appeared to be some sort of promotional specification for the Econet.

Of these 'Atomic Theory and Practice' was the only document in its final form and, as a microcomputer user document, is of a reasonably high standard. It is 212 pages long, is paginated, includes a table of contents and succeeds in being entertaining and informative with numerous examples. Apart from the DOS manual, the other documents appear to be preliminary versions of different ages and variable accuracy, generated during the Econet project, and describing features some of which do not yet exist. No doubt they will become more accurate as they are prepared for final publication but the overall impression is again of reasonably well-written clear descriptions of features and of technical specifications, complete with circuit diagrams. The style of these, however, is not a tutorial nature, in contrast with 'Atomic Theory'.

Expansion

The minimum Econet consists of two linked Acorn System Twos each with a few k of memory, an Econet interface and only machine code capabilities; one with a cassette for backing store. Currently the maximum an Econet can contain is 255 Acorn System Fives each with 64k memory and two double sided double tracked minifloppy drives (no file-server), along with a wide assortment of interface cards. The Acorn sales literature promises even larger systems with up to 64k stations connected on subnetworks, all talking to each other and to other computers on the much faster Cambridge Ring.

If there are hardware limitations on an Econet, it isn't with the number of stations one can attach to it but with the size of each station. Larger and faster (Winchester?) disks are needed for a network of any size. On the software side, Acorn offers a fairly limited choice of options for future expansion and extensions to its sparse catalogue of system software would not go unappreciated.

Prices

As there is a wide range of products that can appear in an Econet configuration, the list below is a sample of the more commonly purchased products. These prices exclude VAT.

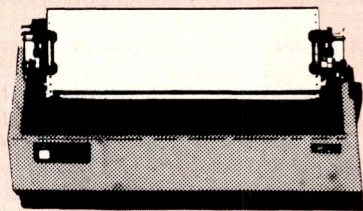
Minimal Atom kit with integer Basic	£120
Fully expanded Atom with graphics and floating point Basic	£250
Mains adaptor	£ 8
Keyboard and cables	£ 96
Hitachi 9in B/W monitor	£136
Colour monitor	£365
Acorn System 3 (1 floppy drive)	£775
Acorn System 5(2 ds double track drives)	£1650
File Server (full version) and Print Server	£100
Atom Econet card + software ROM	£ 50

or 132 Column Printers call **Micro Peripherals**

OKI MICROLINE 83

Complete with RS232 interface

*9x7 matrix *132 column
*Friction and Pin Feed
*4 chr sizes *120 CPS bi-directional *96 chr set plus 64 block graphics

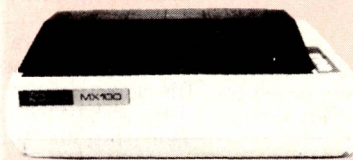


OKIDATA MICROLINE 83 £799*

EPSON MX 100

The ultimate in Matrix Printers

Dealer Special



*Friction *Tractor *136 column *22 different chr sizes *7 International chr sets *Up to 254 chrs per line *9x9 matrix *80CPS bi-directional *True descenders *High geared *High res graphics (1632 dots/line)

EPSON MX100 £575*

NEC SPINWRITER

Rugged, reliable correspondence quality printer



*55CPS bi-directional
*Interchangeable thimbles *Proportional spacing *Tractor option

NEC SPINWRITER 5510 £1350*
NEC SPINWRITER 5530 £1350*

QANTEX 6000P 6000S

Low cost, compact



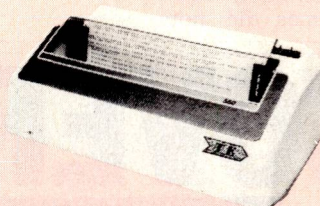
*9x9 matrix with descenders
*150CPS bi-directional *Logic seeking *136 chrs/line *96 chr set *Exp chrs *Parallel or serial int.

QANTEX 6000P (Parallel) £call
QANTEX 6000S (Serial) £call

PAPER TIGER 560G

For high quality correspondence quality printing

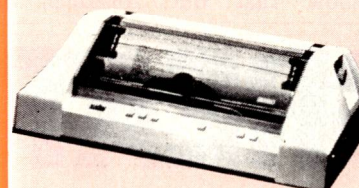
*160 CPS bi-directional *132 column *High res graphics
*2K buffer *Double width chrs
*RS232 or Centronics interface
*Up to 14.75" paper *Tractor feed *Up to 6 part paper



PAPER TIGER 560G £995*

ANADEx DP9501

High resolution matrix printer



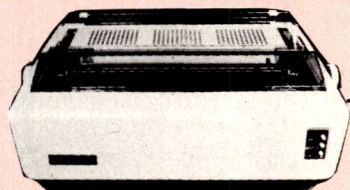
*11x9 matrix *High resolution graphics *200 CPS bi-directional *X-on/X-off
*RS232 interface *4 print densities 10, 12.5, 15 and 16.7 chr per inch

ANADEx DP9501 £call

VISTA -TEC

Daisy Wheel letter quality

*25CPS *Letter quality
*136 column *Proportional spacing *Bi-directional *Diablo compatible *Friction feed



VISTA-TEC £950*

MICRO PERIPHERALS are the UK's largest suppliers of Epson Printers and independent printer specialists.

*1 YEAR GUARANTEE on all printers (except NEC and TEC).
*FREE DELIVERY (UK mainland only) *SPECIAL DISCOUNTS for Educational Establishments *FREE PRINTOUT and data sheets on all printers (call today). *DEALER/TRADE/OEM prices are available (call 'Trade' Sales today). *FREE EXPERT ADVICE on all our printers *DEALER EXPRESS SERVICE if orders are placed before 11 am, delivery will be made by same day (50 mile radius of Basingstoke (inc.London) there is a small charge for this service. *BARCLAYCARD/VISA/ACCESS accepted for telephone orders. *CREDIT facilities can be arranged. *ENTER YOUR SCHOOL into the National Education Computing Competition (ask for details).

Micro Peripherals

61 NEW MARKET SQUARE, BASINGSTOKE, HAMPSHIRE. Telephone: 0256 56468

ALL PRICES QUOTED ARE EXCLUSIVE OF V.A.T. BUT INCLUDE DELIVERY !!!

The Printer Professionals



Acorn Econet Eurocard + software

ROM	£ 60
Pascal	£ 60
Seikosha printer	£195
The review configuration would cost:	
4 Maximal Atoms	£1000
1 Acorn System 3	£ 775
1 keyboard	£ 96
5 b/w monitors	£ 680
4 Atom Econet cards	£ 200
1 Acorn Econet card	£ 60
4 mains adaptors	£ 32
1 Seikosha printer	£ 195
Assorted cables and connectors	£ 20?
Sum	£3058
VAT	£ 459
Total	£3517

The price of a four-user system based on an Acorn System Three File Server would be:

Review Machine (a three-user system + printer) £3058

1 maximal Atom + monitor + power supply + Econet card and cables £ 449

File Server £ 100

Sum	£3607
VAT	£ 541
Total	£4148

The price of an eight-user system based on an Acorn System Five File Server would be:

9 fully configured Atoms (with Econet card) £4041

1 Acorn System Five £1650

1 keyboard, monitor, and Econet card £290

1 Seikosha printer £ 195

1 File Server £ 100

Sum	£6276
VAT	£ 941
Total	£7217

Although an Econet system is inexpensive per station (for the three-user, four-user and eight-user systems priced above, the costs are £1172, £1037 and £902 per station respectively) the above calculations show that

Atom Technical Data

CPU	6502
Memory	RAM 2k-12k, ROM 8k-16k
Keyboard	60 keys including cursor
Screen	32x16 alphanumeric (uc and reverse video), 256x192 point graphics
Cassette	Kansas City CUTS
Disk Drives	Not tested disk system with BASF drives promised
Printer	Seikosha printer (and other parallel printers)
Bus	Acorn's own 64-way Eurocard socket
Ports	Cassette Interface, parallel port, Econet port
System Software	COS
Languages	Acorn Basic, BBC Basic (soon), Assembler, Pascal

Acorn's ads are slightly misleading — 'A ten station network with 400 kbyte file station costs around £3000 and as little as £40 for each additional station.' Ten stations for £3000 implies that users have 2k RAM and no monitor on their Atoms, while £40 per additional station implies that the station has already been purchased and only the interface card is required.

Conclusion

The review configuration was delivered directly from an exhibition where it had received three days of battering from thousands of children. It seemed none the worse for wear. We had occasional hardware difficulties that didn't reappear when cables were disconnected and reconnected. Our overall impression was that the hardware was as robust as one could expect of a system with numerous temporary connections. For a permanent system, channelling for the cables would be strongly recommended.

The nicest thing about receiving a system direct from a show is that there was a full games disk. Numerous friends spent many enjoyable hours playing Dogfight, Rattrap, Astro, Space Invaders (all three versions) and Break-out. Although these games did not

demonstrate the powers of the Econet, they did much to show off the Atom as an ideal inexpensive machine for games — complete with graphics (256x192) and sound. If Acorn had had multi-station games we might never have got around to returning its system, let alone writing this review...

Acorn Computers are relatively inexpensive, flexible bus-based micro-computers, ideal for laboratory use, whereas Atoms are very inexpensive, if limited, all-in-one micros. The Econet is an inexpensive method of hooking virtually any number (actually 244) of either of these micros together so that they can share more expensive resources. The hardware configuration appears to be quite sensible. Unfortunately, at the time this review was written, the accompanying software was rather primitive — and the software a user sees may make the difference as to whether a system is desirable, acceptable or useless. We hope that, despite having obtained the BBC micro contract, Acorn (whose products have always shown a streak of originality) will not become too pre-occupied to provide this potentially powerful system with the software support it so patently needs.

THE GREAT COVER-UP!

Not since the days of Watergate has there been a public scandal of such far-reaching implications.

It has recently come to the attention of the PCW Secret Police that certain regular readers have been storing their valuable back issues 'au naturelle'.

We consider this practise to be singularly lacking in dignity, and would therefore appeal to you in the name of common decency to please ensure that your magazines are properly dressed at all times.

This may be achieved by the simple expedient of purchasing one or more of our sturdy yet colourful PCW binders.

So why not join in the great cover-up and preserve your precious PCW's in their original pristine perfection.

Just check the coupon at the foot of the page.



Please send me — PCW Binders at £3.25 each

NAME _____

ADDRESS _____

(Block capitals please)

I enclose cheque/P.O. for £ _____ made payable to _____

Sportscene Publishers Ltd. (Binders),
Send coupon to PCW (Binders),
14 Rathbone Place, London
W1P 1DE. Allow at least
14 days for processing.

SECRETS OF SYSTEMS ANALYSIS

PART 11: IMPLEMENTING A COMPUTING SYSTEM

Lyn Antill continues her series on bridging the gap between users and experts.

At this point in the series you will have worked out exactly what your system is supposed to be doing for you. You will have bought a machine and all the accessories — cables, paper, floppy disks, etc. And, finally, you will have either bought a program package or had a program written for you, and tested it. Now you are at the nail-biting stage — ready to go live.

Getting to know the program

You've probably done this already during the testing but perhaps some of your staff have yet to try it out. If you bought a package, you may not have spent much time using it, so it would be a good idea to practise. Get to know the manual or operating instructions. You may not be able to remember all the routines that you have to perform, but if you can understand what's in the manual then you can look up any tricky bits when you need them.

It's very easy to follow the set piece instructions which they often give at the start of the manual but it's not always so easy to sort out how to get started on your own data. If you have any doubts about doing this, then start with a few simple examples of your own work and follow these through all the stages until you are feeling more confident.

Often, the most difficult part of running a system is getting it going and since this is also the time when you are least familiar with the program and the machine, you have to be prepared for things to be a little more difficult. You're probably thinking that you've been patient for a long time now, working slowly and carefully through all the stages. Well, there's only one more stage to be careful about, so don't rush things now!

The changeover

There are basically two ways in which you can change over from one system to another. You can run the two systems in parallel for a test period, until you are happy that the new system is working properly, or you can go 'cold turkey' by switching one off and the other on. Each of these methods has advantages and drawbacks.

The advantage of a parallel run is the security it offers you. You can look at the answers you're getting from the new system and compare them with those from the old. If you like them, well and good; if you don't, then you can do something about it before you have to rely on the new system entirely. It is

often not possible to run two systems completely in parallel — I doubt if your customers would like to receive duplicate invoices, or if you would wish to make payments twice over. But there's no harm in keeping two sets of books (as long as they agree).

Parallel running presents the same difficulties that I mentioned last month, in that you will often need to have the same piece of paper (such as a customer order) in two places at once and you will have to arrange a fairly careful clerical system to make sure that everything gets processed properly and none of these bits of paper get lost. This brings us to the final disadvantage of parallel running. Your staff simply may not have enough time to put everything through twice. Large companies can take on a few temps while the regular staff act as supervisors, telling the temps what to do. This may not be practical in a small firm, either because of the expense of hiring temporary staff, or because the work can only be done by someone who knows the system.

All the problems of duplicating your efforts can be avoided by making a sudden change, say over a weekend, from one system to the other. However, once you've gone over to the new system you're stuck with it. If you've found that it's got your records into a muddle, you'll just have to unuddle them. There's no chance of having a quick look at what's gone through the manual system. This means that you have to be rather more careful about your testing and about the way in which you have entered all your old data. There is a certain amount of adrenalin in this approach which does help you concentrate, and to put more effort into getting the new system right. I still haven't forgotten the excitement of watching my first system go live in this way. It was in a bank, which was even more exciting because they are so careful about their records. Of course we did have some way of checking that the answers coming out of the computer were correct because the dealers kept their own records of their transactions, as did the cashiers. At the end of the day we were £3 million out! It took some frantic debugging to get things right but within three days everything was okay.

If you decide to go for the clean break, then you must have some way of checking your computer records — but then you should have that anyway. You cannot just rely on the computer getting it right for you. I doubt if the Inland Revenue or the VAT man would accept unchecked computer figures as an excuse for getting your tax returns wrong. Your auditor would not be

impressed by this excuse and neither would it help you to keep a check on your stock position. There must always be some outside realities that you can check your computer records against money in the bank, stock on the shelves, carbon copies in the filing cabinets.

So, how do you decide which option to go for? Partly it will depend on how you feel about it. Are you a gambler by nature, do you like a bit of excitement? Or would you prefer the slow steady approach, even if it did involve some overtime? If it is vital that your records be accurate, then you must be sure that you have some way to check them, as the bank did in my example. If you suddenly change your stock records over to a computer and then find that the only way you can check them is by doing a complete stock-take each night, you may well decide that a parallel run would be preferable. However, if you can do a quick check against cash in the till, or against a manual list of work that you've run up as you were entering it into the computer, then the quick changeover would be quite safe.

If both of these options seem to involve too much hard work at once, then you may decide to compromise in ways that many users of big computers would. This would involve doing a parallel run on one section of the work at a time, and can be less of a strain provided that it's easy to separate out an identifiable area which can be computerised without upsetting the manual operation of the other parts. With a book-keeping system, for example, one could start with the sales ledger and then add the invoicing, leaving the purchase ledger, stock control, etc., to a later date. Alternatively, you might try maintaining just a few accounts on the computer, as well as keeping your manual records. It all rather depends on how many accounts and transactions are involved.

Taking on the data

This has to be done carefully, because if you start off with duff data, nothing will ever be right. However, this presents far fewer problems for the micro user than for someone with millions of records to enter into a mainframe. The chances are that you can get things up over a weekend, or at a time when business is slack.

Is the data already in the right sort of format? You may be unlucky and find that your existing records don't keep quite the same bits of information as you're going to want to put on the computer, or else that you're going to be combining data from two different

+ VAT

MZ-80 Computer 48K	£478.00	£71.70	£549.70
MZ-80K 28K UPGRADE	£87.00	£13.03	£100.05
MZ-80 I/O Interface Unit	£62.00	£6.30	£48.30
MZ-80 FD Dual Disk Drive	£693.00	£103.95	£796.95
MZ-80 FDK Additional MZ-80FD	£616.00	£92.40	£708.40
MZ-80 RS232 Interface	£110.00	£16.50	£126.50
MZ-80 P3 Matrix Printer	£430.00	£64.50	£494.50
CP/M Operating System	£196.00	£29.40	£225.40
PC-1211 Pocket Computer	£91.00	£13.65	£104.65
CE-121 Cassette Interface	£12.60	£1.89	£14.95
RP1600 Daisywheel Printer	£1450.00	£217.50	£1667.50
Ledger and stock control packages free with computer systems			

PCW

places. If that's the case, then it might be difficult to copy stuff straight from your existing books into the computer. It might be easier to do the job in two stages. Find out exactly what data you're going to be entering into the computer — what items, in what order, is there any limit on the number of characters in a given field, or on the value of particular items? Create a form on which you can write the input data. Try it out on a few records just to make sure and then get loads of them printed off.

Before you can take on any data, you have to call a halt on the processing of anything on the old system. Do whatever checking you can on the old system and then leave it alone. Decide on the order in which you will work through the old books and stick to it and that you don't walk off and leave anything halfway through — you'll only lose your place! It really does pay to check and double-check at this stage. Jobs like going through all your customers and copying their names and addresses are so boring, and so simple, that you will make the incredible number of stupid mistakes. If you cannot put the data straight into the machine, then fill in the forms you have prepared, check these and then type the data into the computer. You'll need to check your typing against the forms but you should also cross-check it against the old records where possible.

You may, again, be faced with the problem that there is just too much data to take on at once. A possible way out of this is to enter all the fixed bits of data first. Things like names and addresses aren't going to change much

over a week or so and can be entered as and when time's available. Once that's been done, operations can be suspended over a weekend, while the volatile bits of information, like balances and stock quantities are added. This reduces the amount of work to be done during the frantic period with a consequent increase in the likelihood of everything being done properly with minimum disruption to your business.

Running the new system

It is always difficult getting used to something new. This is the time when you are most likely to make a mistake, and when you will find it most difficult to correct any mistakes because you don't quite know how. This lack of familiarity with the system can sometimes make an operator feel a bit harassed; others react very differently because they are enjoying the novelty and may try to rush ahead. Either way it is important to build up good habits right from the start. Apart from all the normal good office habits of orderliness, etc, there are specific procedures associated with a computer system. Most important of these is taking backup copies of data and programs and the safe keeping of floppy disks. Everybody will get the occasional data corruption, but there is no doubt that some people get more than others, because they are careless.

A microcomputer is part of a complete system and its operation must be meshed in with all the other things going on around it. Once programmed,

it is just another bit of office machinery which must be treated properly and which will soon find its place in the working routine. You'll soon find what you can and can't get away with but do try to avoid any disasters in the early stages — they're bad for morale!

One thing that always surprises programmers is the way in which users manage to adapt the way they use programs to deal with more applications than were originally intended. A non-programming user tends to take the program as given and uses his imagination to see other uses for the data. One technical college showed me their student records system in which they had to condense a lot of information into a limited number of fields. When the operator discovered that she needed to store an extra field after a student had withdrawn, she simply put the data into a space that would have held something else but which wasn't needed any more. So the program was doing an additional job and she hadn't had to call in the programmer. Even if she had, he would have had difficulty finding any extra space.

Running a system on a microcomputer isn't so different from running it any other way. You still have to be methodical and work out procedures for doing and checking each stage of the work. We're back with the 'dumb clerk' I talked about at the beginning of the series. The micro is a willing, but unintelligent, clerical assistant. The only sense in which you have to be more careful when operating a micro is in the keeping of data. You always did have to

GOTO page 142

PET COLOUR

COLOUR displays on standard Uk Colour Tv's in tandem with PET VDU

COMPLETE BOARD
AND LEADS
READY BUILT & TESTED

: £79.60 + 15% VAT

- FOREGROUND & BACKGROUND OF ALL SCREEN CHARACTERS INDEPENDENTLY PROGRAMMABLE IN 8 COLOURS.
- PLUGS INSIDE PETS, NEW OR OLD ROMS.
- ALL NECESSARY CONNECTORS SUPPLIED.
- MEMORY MAPPED, 1K IN 4, D.I.L SWITCHABLE.
- UNIQUE POWER-ON RESET GIVES BLUE FOREGROUND CHARACTERS, INITIALLY.
- DOCUMENTATION SUPPLIED. EASY TO USE.
- TV SOUND CAPABILITY, SIMPLE INTERFACE.

If you are unsure of the Type of your PET, please state Series, (2/3/4000, not 8000).
(V.OLD 8K PETS have 6550 RAMs.)

To: THERMAL PRECISION, The Hermitage
Course Road, Ascot, BERKS. SL5 7HH
Tel: Ascot (0990) 24543

ORDER FORM — BLOCK CAPITALS PLEASE.

CHEQUE ☐ P/Order ☐ ENCLOSED for £91.54

PET TYPE — NEW ROM ☐ OLD ROM ☐ V.OLD 8K ☐

NAME _____

ADDRESS _____

POST CODE _____



TOM'S TANDY PROBES PRANGS

Road accidents cost Britain dearly, not only in terms of human misery but also in the £1.5m it costs the taxpayer each year. David Tebbutt reports on a man who's doing something about it.

Bill Jones was driving home after a pleasant weekend with friends. Feeling relaxed, he was keeping to the country lanes well away from the rush of the motorway traffic. His attractive wife was by his side and his two young children were playing happily in the back. A split-second later, the car was a mangled heap at the roadside, and the children were all badly injured, and his wife lay dying. Another car had hit them head-on. Its driver and four passengers were also badly injured. The road was wide enough for the vehicles to pass each other and neither car was anywhere near the speed limit allocated to that stretch of road. So what happened? And, more importantly, what can be done to prevent this sort of horror?

Tom Ravensdale is a man who knows the answers.

The Company

Tom runs an accident research and investigation company in East London. He is regularly approached by solicitors and insurance companies who need to know as accurately as possible what happened in an accident. Sometimes the approach is made years after the event, and Tom has to unravel the truth from a mass of often-conflicting statements, plus any evidence which may have been collected at the time of the accident. He always visits the scene to take his own photographs, make measurements and note things like tree positions, type of road surface and so on. He then works through all this information, extracting the relevant bits for subsequent entry to his accident research program suite which runs on a Tandy TRS-80 micro-computer. This suite incorporates formulae derived from the laws of Newtonian physics first observed by Galileo and later formalised by Newton in the 17th century, together with the results of more modern activities, such as the American research into crush factors. By crashing cars into solid objects, a team has produced tables of the energy required to produce different degrees of distortion of vehicles under various circumstances (angle of impact, whether the collision is with a solid or moveable object, etc). Other files within the system hold details of every common motor vehicle used in Britain, including information such as kerb weight, ground clearance, tracking and centre of gravity.

Tom, together with his system, is then able to assess the likely cause of accident and, if necessary, stand up in

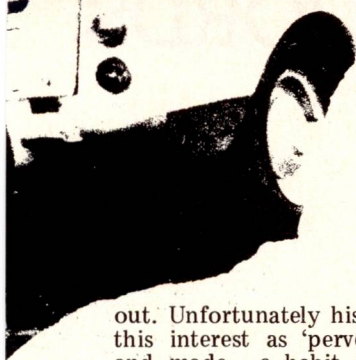
court as an expert witness and make statements like: 'Car A was travelling on the correct side of the road at between 49 and 53mph immediately prior to the accident.' This sort of statement by an expert is absolutely invaluable in unravelling things like insurance claims. The fact that Tom cannot be more precise in his speed estimate would be irrelevant if, for example, this accident happened in an area where the speed limit is 30mph. It is clear that the vehicle in question was exceeding the speed limit.

Tom's motivation to do this type of work is that he feels very strongly that many accidents are clearly avoidable and there is no need for the annual carnage that takes place on our roads. Did you know that every year 6500 people are killed on Britain's roads and God knows how many are maimed for life? Go into the orthopaedic ward of any hospital and count the number of motorcyclists receiving treatment — it will usually be the majority of patients. Each year 70,000 motorcyclists are killed or injured in Britain alone.

Tom is at heart a researcher; in addition to running the business, he is currently investigating motorcycle conspicuity at Loughborough University — trying to find answers to questions such as: should motorcyclists drive on dipped beams; what colour clothing shows up best? It is to fund this sort of activity that Tom actually runs his company. This means that he drives himself extremely hard, usually working 18 hours a day and often as many as 20 or more.

Background

In order to explain how this business came about it is worth delving a little into Tom's past. When he was a child he had an almost obsessive interest in Gray's *Anatomy*. By the time he was ten he probably knew more about the human body than most of us ever find



out. Unfortunately his parents regarded this interest as 'perverted' and 'dirty' and made a habit of walloping him whenever he was caught reading the book. Tom even took to reading it beneath the bedcovers by candlelight. This was all very well until the day he set his bed on fire and almost killed himself! Anyway he survived and went on to lead a most remarkable life.

When he was 14 he left home and roamed around Europe doing odd jobs, returning to England after a few months only to be picked up by the police and taken home. As soon as he was 16 he was off again and became very interested in motorcycles. For nine years he toured the world racing bikes, using the start money from one race to finance the trip to the next. Now, while Tom won his fair share of races, he also had more than his fair share of accidents. He even managed to fracture his skull twice — once in Japan and then again at Brands Hatch. His final accident happened in Casablanca, where he broke his back.

Spending several months in plaster gave Tom the opportunity to reflect on his life and it also brought him the opportunity to study. Before leaving hospital Tom had passed ten O levels and three A levels. This was just the beginning of an amazing amount of study which was to bring him several degrees and diplomas in the years to come.

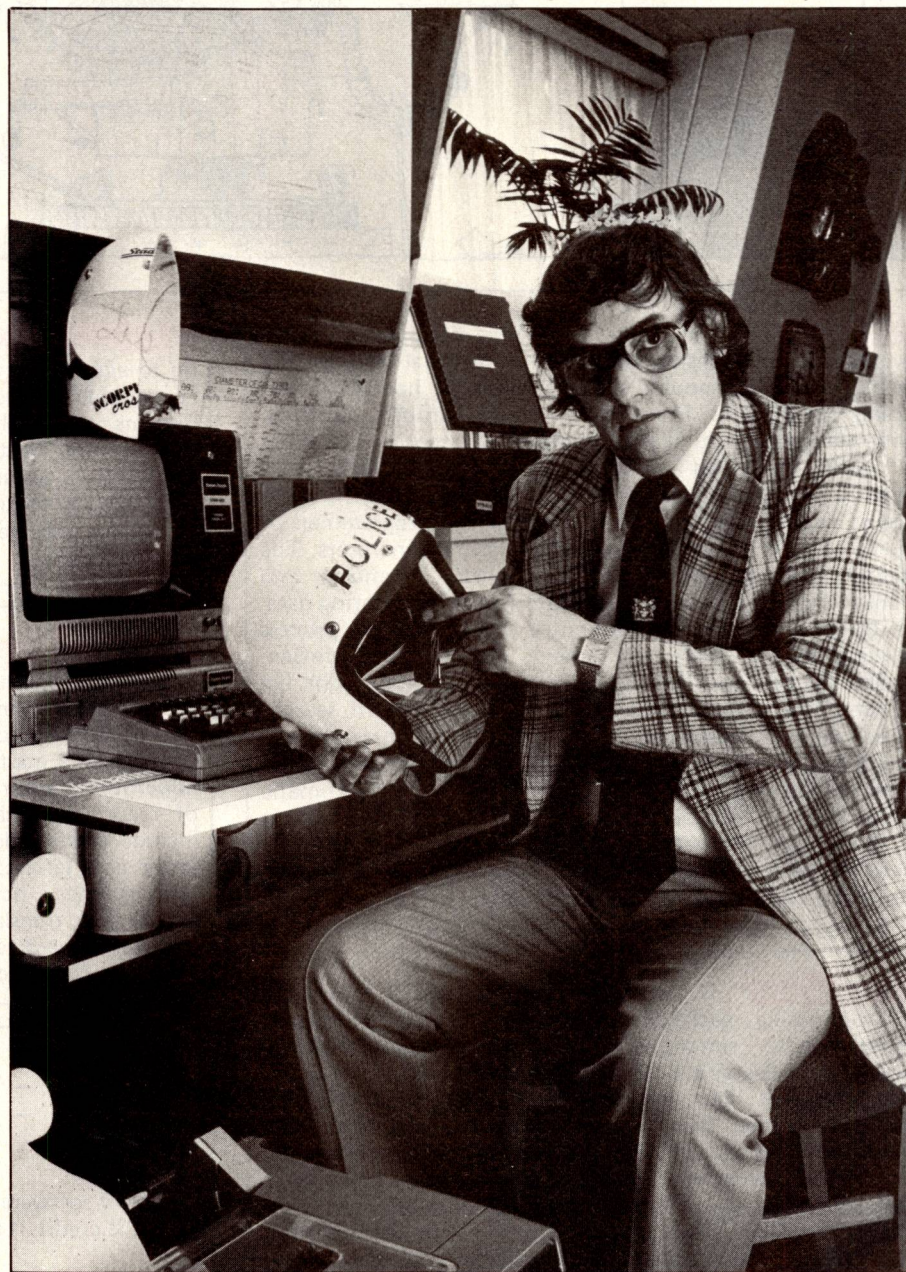
It was while carrying out research into the use of biological simulations in teaching at Reading University that Tom was approached by the Home Office to carry out a 12-month study into the effectiveness of police motorcycle helmets. Tom jumped at the opportunity of involving himself in a campaign very dear to his heart — that of road safety. Apart from 'considerable personal experience of crashes', Tom had once staged an exhibition called Operation Skidlid. He had gathered together a number of his racing cronies to exhibit their crashed bikes and to try and persuade youngsters to wear crash helmets.

Tom embarked on this study with his usual enthusiasm, getting various sponsors to pay for trips to accident research laboratories around the world so that he could take advantage of all the accumulated wisdom of that time. During this work, Tom had a need for information about the types of injury sustained in motorcycle accidents and, as a result, spent a lot of time with a team of doctors, surgeons and pathologists at the London Hospital Medical College, examining people who had died or been injured in such accidents and correlating this information with his findings after examining their crash

helmets. One of the interesting things he discovered was that if you paint or use certain solvents such as petrol on a polycarbonate crash helmet, you render it virtually useless. Tom duly wrote his report and presented it to the Home Office.

By now Tom had really got the road safety bit between his teeth again, so he set up an accident research unit in the London Hospital with the 'massive help of the Metropolitan Police'. According to Tom, these men really bent over backwards to help him. He attended accident investigation courses at Hendon Police College and in the United States, and he's particularly proud to have studied under Stannard Baker at Chicago's North Western University Traffic Institute. Tom attended and investigated several hundred accidents during this research and his final report earned him a Fellowship of the Institute of Professional Investigators.

sequently Secretary General) of The Law Society from 1939 to 1969 and he was also instrumental in founding the British Academy of Forensic Sciences. It was this last activity that was to lead him to Tom. Sir Thomas suggested that Tom could continue his research by providing an independent and unbiased accident investigation service to solicitors and insurance companies. Sir Thomas figured that since the police have access to experts to help them discover what happens in accidents, then the public should have the same opportunities. Tom and Sir Thomas then set up the present company — Private Accident Investigation & Research Ltd — to perform precisely this service. Tom runs the company with the help of his wife Soraya and his son John, plus a number of medical and ex-police consultants. Sadly, Sir Thomas died during the course of my investigation for this case study.



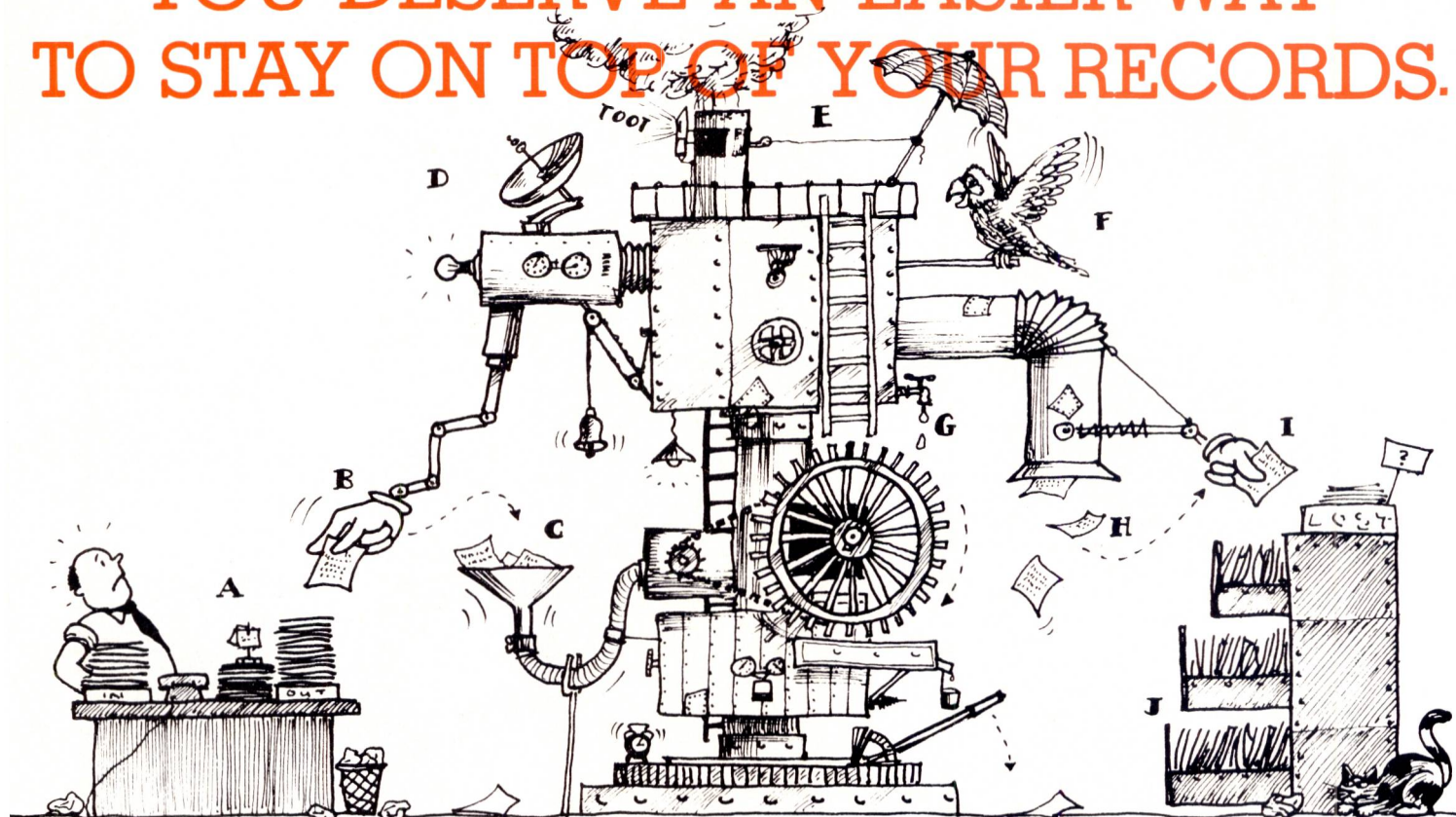
Tom Ravensdale

Towards the end of this particular study, Sir Thomas Lund came on the scene. Sir Thomas was probably best known for his efforts in setting up the Legal Aid and Advice Scheme in Britain. He was Secretary (and sub-

An Investigation

On my final visit to Tom, I asked if we could work through a case together and, rather than present my findings in an abstract, academic way, I shall describe

YOU DESERVE AN EASIER WAY TO STAY ON TOP OF YOUR RECORDS.



DataStar is an easy to learn, yet professionally powerful, comprehensive data entry, retrieval and update system for microcomputer systems. **DataStar** handles record keeping applications from initial design through updating, addition/deletion, and search/ retrieval of records — quickly and easily, even for complex operations. **DataStar** is a powerful program that can be used for an extremely wide range of possible applications by experienced programmers or systems analysts as well as inexperienced first-time users. The **DataStar** package consists of two parts: FormGen and DataStar. Formgen is used to prepare forms for entering data, then DataStar handles the data entry and verification process according to the form requirements defined by FormGen. **DataStar** features include: data entry verification by sight, list and retype; arithmetic operations on fields; record search/ retrieval and edit/ updating; comprehensive help messages and instructions displayed on screen; compatibility with CP/M supported languages e.g. BASIC, FORTRAN etc; automatic documenting of field and form layouts detailing verification etc., horizontal and vertical scrolling allows design of forms exceeding screen width and depth. Application examples: Order entry and invoicing, name and address lists etc.

WordStar is a powerful, screen-oriented, integrated word processing package for CP/M systems. Advanced features include: simultaneous printing and editing, multiple levels of user-selectable help messages, word-wrap, page break display, hyphen help, and extensive print enhancements, including boldface, underline, sub and super script, variable line height and character pitch. Comprehensive screen prompts allow for easy insertion and deletion of words, lines, paragraphs and pages. Gives true screen image of what your print-out will look like, before you print. Use in conjunction with **MailMerge** to automatically insert variable text either from console or data files into standard forms, such as circulars etc.

MailMerge is a powerful file merging tool permitting up to eight levels of nested file references as well as chaining. As variable data is merged with text **MailMerge** automatically reforms paragraphs as required to conform to the margin settings and justification used in the original document resulting in accurately formed and margined documents that look as though each received special attention, all without special intervention, consideration or calculation required by the operator.

SuperSort combines performance and flexibility in sorting, merging and selecting information from data files. It can sort and merge up to 32 files into a single file, at the rate of 560 records per minute. And new records can be integrated into a master file in one simple and efficient operation. **SuperSort** is a star at sorting. It will accept just about any kind of record you can imagine. The data can be justified, or include floating decimals, exponential notation, or upper and lower case letters; it can even be in several standard formats, such as binary, bcd, ASCII, etc. You won't have to waste time and money translating your records for the computer. And you can have fixed or variable length records and fields. In fact, you can have a different number of fields in each record.

DataStar	—	Software*/Manual**	£145/£25
WordStar	—	Software*/Manual**	£185/£25
MailMerge	—	Software*/Manual**	£55/£15
SuperSort 1	—	Software*/Manual**	£95/£20

*Price of software includes manual

**100% credit if software is purchased later



TRADE ENQUIRIES WELCOME

MAIN UK DISTRIBUTOR:

INTERAM COMPUTER SYSTEMS LTD.,
46 BALHAM HIGH RD., LONDON SW12 9AQ
Tel: 01 - 675 5325/6/7 Telex: 925859

Prices and specifications subject to change without prior notice.

CP/M is a trademark of Digital Research Wordstar, DataStar, SuperSort and MailMerge are trademarks of MicroPro Inc.

Please write or phone for free 16-page brochures and flyers.

exactly what happened, making just enough changes so that the particular case can't be identified.

We started with a bundle of notes and photographs provided by the solicitor, together with other notes and photographs taken by Tom at the scene of the crash. The bundle contained masses of correspondence between the people involved in the accident, the insurance companies and the solicitors. In addition there were statements taken by police from victims and witnesses, insurance claim forms, plus maps of the scene drawn by both the police and by Tom. Had there already been a court case relating to the accident, then the court record would also have been in the file.

The particular accident I worked on is the one mentioned in the opening paragraph of this article. Mr Jones was indeed driving along on his own side of road when a car coming in the opposite direction hit him head on. The accident happened in the rain on a curve and a number of people were injured. Tragically, Mr Jones' wife died of her injuries. A witness to the accident claimed that the car which hit Mr Jones' vehicle was on the wrong side of the road at the time of the accident. From impact damage and the vehicles' final resting positions it was easy for Tom to confirm this statement.

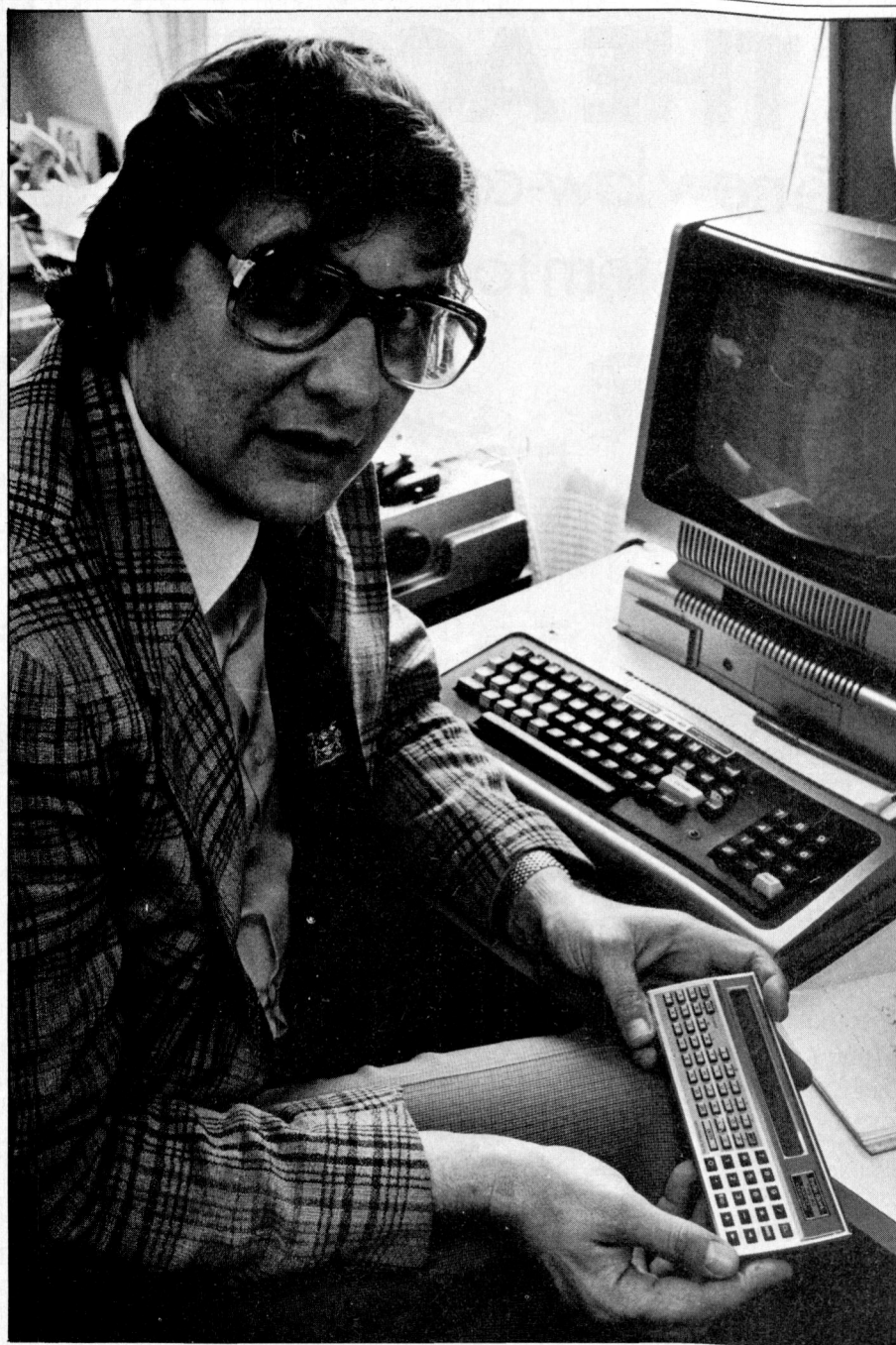
According to all parties involved, there was water lying on the road. The police noted that it extended right across the road for a distance of some 30ft and lay about a quarter of an inch deep over most of its area. The tyre pressures and tread depths for both vehicles had been recorded by the police and Tom made a note of these. He also noted the make and type of each car involved. Finally he extracted details of the curve, specifically the chord and middle ordinate lengths. These were to be used later to work out the radius of the bend.

Armed with this information, we moved across to the computer. Tom's machine is a 48k TRS-80 Model 1 level 2 with four disk drives, two printers, an acoustic coupler and upper/lower case characters. He's tweaked the drives so that the Tandy ones have 40 tracks and the Micropolis ones have 80. One of the printers is a unidirectional, upper-case only machine while the other is bidirectional with full upper- and lower-case characters. The first thing we did was to establish the radius of the curve. Tom called up the appropriate routine, popped in the chord and the middle ordinate figures and was presented with the result:

WITH A CHORD LENGTH OF 110 FEET AND A MIDDLE ORDINATE OF 2 FEET, THE RADIUS OF THE CURVE WILL BE 757.25 FEET OR 230.961 METRES.

Although Tom was instinctively aware of the sort of speeds that such a curve would allow, he still went through the full procedure so that I could understand properly.

The next thing he did was to call up a routine based on a standard police formula which works out a safe negotiating speed for a given curve, taking into account camber and the coefficient of friction of the road surface. You may notice that this particular formula takes no account of the type of vehicle. The notes revealed an adverse camber



The pocket Tandy comes in handy.

on the road and Tom entered the camber angle followed by the coefficient of friction which made allowance for the fact that the road was wet. Immediately the system presented a result:

THE CRITICAL SPEED FOR A CURVE WITH A RADIUS OF 757 FEET AND A COEFFICIENT OF FRICTION OF .5 WITH AN ADVERSE CAMBER OF 1 IN 25 IS: 72.0052 MPH; 105.89 FEET/SEC; 116.267 KPH; 32.2964 METRES/SEC. THE ACCELERATION/DECELERATION RATE IS 16.1 FT/SEC/SEC.

The next thing to do was to look at the make and type of vehicle. Tom keyed this in and his 'vehicle data retrieval' program responded with all the relevant facts about that particular car; namely the kerb weight, gross weight, height, width, length, wheelbase, front track, rear track, ground clearance, turning circle, engine size, maximum speed and centre of gravity. The system then went on to give details of the maximum safe speeds for this particular vehicle, taking these factors into account:

WITH A RADIUS OF 757 FEET, A RADIUS OF GYRATION OF 2.5 FEET AND A CENTRE OF GRAVITY OF 1.78 FEET, THE MAXIMUM SPEED WITHOUT OVERTURNING IS: 56.278 MPH, 82.7137 FEET/SEC; 90.8196 KPH, 25.2277 METRES/SEC.

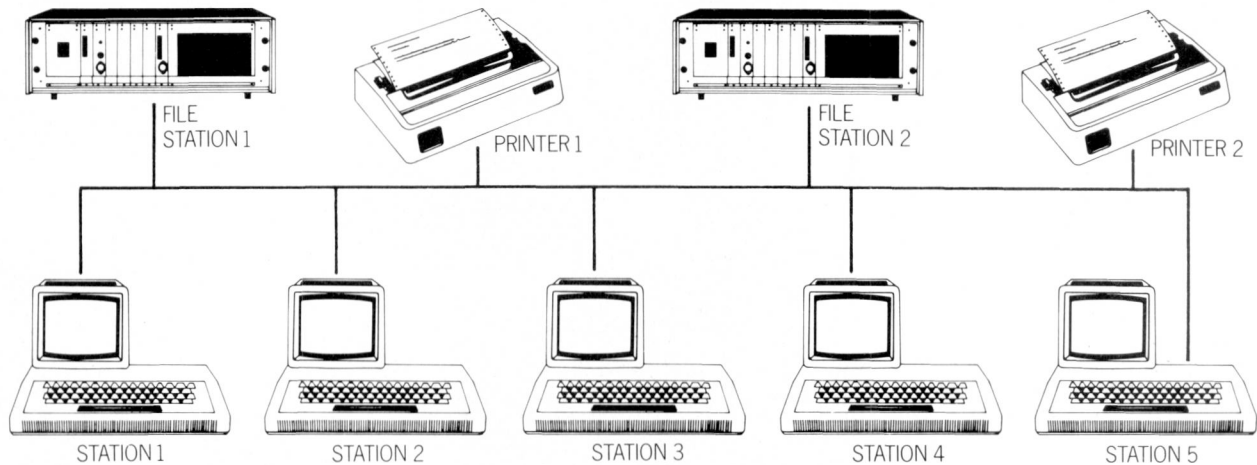
Interestingly, the system told us that the maximum safe speed for this particular vehicle under these conditions is only 56 mph.

In order to doublecheck the findings so far, Tom entered details of the damage to each vehicle. To help him do this, a menu appeared which offered the choice of eight types of impact. He chose a head-on impact with another vehicle and entered the depth of crushing at the front of the car. The system replied with an estimated speed on impact of 42.9mph.

Since the collision speed for both vehicles (we had checked the other car, too) was considerably less than the theoretical critical speed for that curve, Tom had to look for possible causes of the loss of control. You'll remember that a quarter of an inch of water was

THE ACORN ECONET

The new low-cost interconnecting communication system for computers and peripherals.



“To our knowledge the Econet is by far the lowest cost network available in the world.”

A ten station network with 400K byte file station costs around £3,000 and then as little as £50 for each additional station interface.

WHAT THE ECONET DOES

The Econet communications network system has been developed to enable up to 255 Atoms and/or other systems to communicate with each other almost instantaneously and to share facilities such as disks and printers. The network is totally democratic. All stations can communicate with each other independently unless specifically prohibited at a data transfer rate of up to 210 kilobaud. Any station can be set up as a master station with an ability to define priorities and open or close facilities to subordinate stations. The master station can however communicate with all stations at once or singly.

HOW THE ECONET WORKS

All the stations on the Atomic Network are connected together in the network by ordinary 4-wire cable. There is no specific direction of flow of data; the network simply ensures a path between any pair of stations.

1. Before transmitting on the network a station listens until the network is free.
2. If two stations transmit simultaneously the 'collision' is detected by a circuit on each station's Econet interface and both stations stop transmitting.
3. After a collision is detected, each station causing the collision retries immediately, or abandons the attempt and continues listening until the network is free again. The course of action taken is determined by a 'collision-arbitration' algorithm ensuring that no two stations go through the same sequence of actions.

In practice these procedures give very efficient use of the Econet, with the minimum number of retries.

During the time that two stations are in communications the network is kept continuously busy, so there is no opportunity for another station to interrupt and cause a collision. Once the conversation is finished the network is released, and other stations waiting to use it will again compete to gain access to it.

ECONET'S ADVANTAGE OVER TIMESHARING

- Each Atom station costs less than a typical terminal on a timesharing system.
- Each station runs programs at maximum processor speed; extra stations don't slow the system down.
- Each station is independent; a fault on one station doesn't affect the others.
- The Econet is far more flexible than a timesharing system.
- Extra facilities can be added as self-contained units.

ECONET WITH OTHER ACORN SYSTEMS

- Any Acorn Eurocard System or standard Atom can be added.
- Compact hardware modules fit neatly inside the Atom.
- A ROM carries the software for low level network commands.
- Sophisticated file server/printer server software is available.
- At its lowest level the Econet can be fitted to two Atoms only.

FIND OUT MORE!

For comprehensive information about Econet simply fill in the coupon below and post it today. Full details will be sent to you straightaway.



**ACORN
COMPUTER**

Acorn Computers Limited
4a Market Hill,
Cambridge CB2 3NJ

To: Acorn Computers Ltd., 4a Market Hill, CAMBRIDGE CB2 3NJ
Please send me full information about the ACORN Econet

Name _____

Establishment _____

Address _____

Postcode _____

Telephone No. _____

PCW 7/81 E

lying on the road, so Tom dug out the notes for an earlier hydroplaning (we often call it aquaplaning) accident. He'd worked out some new formulae for this type of case, based on tests conducted by NASA on the effect of depth of water on runways for landing of aircraft. Tom wrote a new piece of code and patched it into the system while I sat there. He then provided it with the appropriate figures, including tyre pressures taken from the police report, and the system replied by telling him that the maximum 'safe' speed for this curve ranged from 47 to 51mph under these conditions.

The message was clear: the curve at the time of the accident was not safe at much more than 45mph. In fact, the local council had rated it as a 60mph road when it should really have been rated as a 30mph road, since the figures arrived at during this investigation were all maxima.

As a final check, Tom re-read the case notes and one of the police statements said that they had tried negotiating the bend under similar conditions and they'd experienced great difficulty controlling the police car at more than 50mph. Needless to say, this paragraph almost leapt out of the page at us!

In this way, Tom is able to use the same methods he has always used to do his accident investigations, except that now the calculations are done in a fraction of the time it used to take.

The example we worked through highlights only a few of the many facilities that Tom has built into his system. One of the major functions gives him the ability to break down a skid into fractions of a second, showing the speed and position of a vehicle at each moment. He can, using standard driver perception and reaction times, establish where a pedestrian might have been prior to an accident. Until recently, if a pedestrian had been knocked down on a crossing, the driver has usually been given the blame. Tom can tell, for example, whether the pedestrian was actually on the pavement when the driver realised that he or she was about to run out into the road. He can also tell to a certain extent whether witnesses are telling the truth. On one occasion someone told him that they'd heard the skid, rushed out into the road and seen the crash happen. Tom was able to demonstrate that this was impossible since the accident happened on a curve and that the sound of the skid had first taken a while to reach the witness's ears. The witness had then to run into the road in order to see the site of the accident, by which time it would have all been over. In a similar way, Tom can work out things like who might have been first to enter a junction in a crossroads collision. He can even calculate the speed of each vehicle prior to impact from their final resting positions.

The list is almost endless. In the case of accidents involving motorcycles, Tom can work out the relevant details from vector analysis, which takes into account the resting places of both the bikes and the riders. Tom is currently perfecting a new series of equations which deal with vehicle speeds estimated from projections and trajectories.

Apart from a few utilities and his

own system, the only other program Tom uses regularly is his Scripsit word processing package which produces all his final reports.

Computing background

Tom first encountered computers when he was an Open University student in 1972. At that time he was purely a user making use of statistical packages, although one of his courses was a systems course. He was to wait a further five years before becoming heavily involved in the programming side. In 1977, while studying for his Dip FE in research statistics at Garnett College, Tom finally found the need to use the college computer. His particular requirements were so specific that he had to learn to program in Basic in order to put the system to good use. Since that time, Tom has spent an average of four to five hours daily writing programs in Basic. Of course, having access to a college machine isn't quite the same thing as having your own computer, so Tom bought a TI59 programmable calculator. This was fine for a while, but then he knew he had to get something more powerful — but what?

Now you're hardly going to believe this, but another of Tom's many talents is that he is something of an electronics wizard. He once designed and built a burglar alarm for a motorcycle which started by issuing a spoken warning to a would-be thief if he tampered with the lock. If he sat on the bike, the thing threatened the thief that it would call the police. If he then tried to ride off on it, it did call the police and it screamed to passers-by that it was being stolen. The reason I mention this is that Tom used to haunt his local Tandy store for his electronic components. Just at the time he realised he needed more computing power, he popped into the shop where he saw his first personal computer — a TRS-80. A little bit of research showed Tom that he couldn't get a machine of similar power more cheaply so he went back to Tandy and bought himself a tape-based system, using his oscilloscope in part-exchange!

Starting off with very simple three-line programs which helped him assess vehicle speeds from skid marks, Tom swiftly moved to the more sophisticated routines mentioned earlier in this article. As he encountered a new type of accident, he'd work out appropriate formulae and pop them into the system. It is in this way that the system has grown during the past two or three years. Tom reckons that this accident research suite won't be finished for ten years at least, if ever.

So there we have it: a man who knew that he needed some sort of tool to help him with his complex accident research equations went into a Tandy store and found just the thing. Of course, Tom quickly became frustrated with the cassette tapes and he soon upgraded to a pair of Tandy disk drives. As the database grew, Tom bought a couple of Micropolis drives and, as the printing load increased, he decided to buy a printer. Before long he outgrew even this, which is how he ended up with his present four drive, two printer system. Tom is absolutely delighted with the equipment and considers himself very

fortunate for making the decision to buy Tandy.

It is interesting to note the similarities between Tom and people like David James (see 'The Last One' in February's PCW). They are not computer people by profession. They are essentially users who are convinced that a computer will help them tackle many of their problems. They set about the whole business in an entirely unstructured way, doing a little program here and another there, satisfying their needs as they arise rather than working to some grand master-plan. As they go along they merge programs and bits of programs until they begin to have something which you or I might call a system. And the system works, because each element in it worked at the time it was first written. In this way, some enormously complex, and often untidy, systems are being created. I'm sure that this approach offends the purists but I'm equally sure that these same purists would still be stuck at first base trying to get the user to define his exact requirements before they dared start work on the system design. The fact is that people like Tom often don't know precisely what they want and to get them to commit themselves to ideas at such an early stage quite often robs them of the chance to use the computer's full potential. Now, I know that there's a place for both approaches but, having seen The Last One and now Tom's excellent system, I'd be the last to sneer at what I can best describe as an organic approach to programming — it just grows. I think that this marks just the beginning of the long-awaited micro revolution in which the power of the personal computer is wielded by the user instead of by the data processing industry which hasn't always operated in the user's best interest. And that's putting it mildly!

Some dire warnings

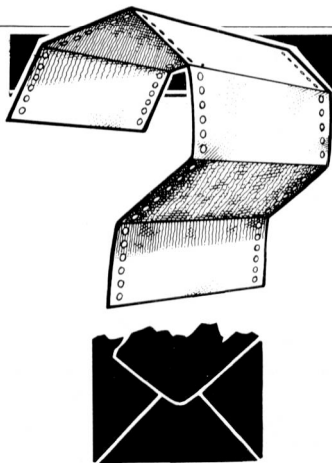
Tom is convinced that the computer is the most 'intellectually addictive device ever made'. He warns newcomers that they must be prepared to spend a lot of time on it if they plan to do their own programming. I'm sure that most programmers would agree that most five minute jobs end up taking five hours! It is because of the interminable hours spent at the keyboard that Tom suggests you buy the most comfortable chair possible because, while you're programming, you are completely oblivious to any aches and pains which might be developing. It's only when you stop that you realise you have the most awful backache.

When it comes to the choice of machine, Tom advises you to buy a 'High Street, mass market' machine which has plenty of software available. He didn't give a lot of thought to software and it wasn't until he'd written a fair number of programs that he discovered they were already available in the shops! Finally, he recommends that you buy the biggest machine you can afford: you are almost certain to need the extra capacity as you find more and more jobs you want to do on it.

The future

Tom's head is absolutely bursting with ideas for his system. For example, it

GOTO page 158.



COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julians Road, St Albans, Herts.

Adaptor wanted

I recently purchased a UHF modulator type UM1111E36 from Interface Components of Amersham. The modulator has a phone socket output and none of the shops I've been to can help me with an adaptor for connecting to a coaxial cable to a TV set. Where can I obtain a suitable adaptor?

Len Wood, Bourne End, Buckinghamshire

You should have no difficulty obtaining suitable plugs and sockets from Maplin at 159-161 King Street, Hammer-smith, London W6, tel 01-748 0926, or 284 London Road, Westcliffe-on-Sea, Essex; in fact, any good electronics/radio shop should be able to supply you.
SW

Tools not toys

I am interested in statistical and other scientific calculations, but the Commodore PET with all of its advantages lacks arithmetic accuracy; my HP 33E calculator calculates to ten-figure accuracy. There are many of us who are interested in using micros as scientific tools rather than toys for playing Space Invaders — can you help on this point?

F M Eggert, London

Any piece of equipment that exists in as many varieties as do computers needs a well-written specification of requirements before a short-list of suitable items can be drawn up. The PET (together with many others) does have limited arithmetic precision. This is not a fault of the hardware but of the version of Basic provided. If a system was chosen that didn't have Basic in ROM it is much more likely that a suitable version of Basic could be found. There are machines that have a double precision capability and have Basic in ROM if this is important. Languages such as Fortran have a double precision capability built in and those

variables that are required to have double precision can be so specified. Any system running under the CP/M operating system could use MBasic, which allows double precision. One of the cheapest systems that has double precision is the Video Genie.

SW

Cow PET

I am interested in using a computer as an 'electronic herd book' to store pedigree cattle identities, together with sex, date of birth and six physical measurements per animal (three-digit integers) so that one or more of the following analyses are possible:

1. List of parents and grandparents with measurements;
2. List of close relatives with measurements;
3. Comparison of measurements of contemporaries.

What kind of computers would be suitable, bearing in mind that I have no knowledge of electronics? This would be very much a 'hobby' development for me in the first instance.

I P Ross, Inverurie, Aberdeenshire

Well, I think this is one of the ideal ways in which to become familiar with computers and programming. You have in mind an application in which you know precisely what you want; it is simple and only requires a small system. You are also starting off by treating it as a hobby, which means that you probably won't be too upset if it takes longer to master than expected.

You have stated nearly as much as I need except for the maximum foreseeable size of herd. This is not of crucial importance as you will see later. You must look for a computer that has good file handling commands and, of course, which has a cassette interface; but let us look at the problem in more detail.

Basically, there are two ways in which we might want to process files — serially and randomly (directly). For the latter, a disk drive is essential, while for the former it is only essential if fast processing is required, otherwise a cassette deck will do. Your application can easily be done using serial files and it remains for you to determine what delay is acceptable before results are obtained.

The next thing to be aware

of is that true file processing requires two cassette decks; this can be overcome provided you have sufficient main store, but in going for a low budget system you are almost certainly going to be short on main memory. It appears that each record will contain about 30 characters after coding and it is easy to work out the memory required for processing by multiplying the number of characters per record by the number of records (200 cattle will require $200 \times 30 = 6000$ ch; ie, 6k of memory). The calculated memory requirements must be over and above the amount used by Basic and your program, so you are unlikely to find an 8k system large enough. However, all this is irrelevant provided the computer supports twin cassette decks, and file commands to access both at the same time. Beware the salesman who will not commit himself on this point. Writing programs to cassette is simply not good enough.

The PET in its cheapest secondhand version with two cassette decks is certainly up to this task but make sure that you get both the cassette deck heads aligned because this is the most frequent cause of error when using two decks. Most micros read cassette files at around 30 ch/s, which means one record per second in your case. With 200 cattle, this will take just over three minutes to produce an answer. Updating the file will take around twice as long as you will have to wait for both reading and writing times for each cassette.

SW

Getting started

I have recently inherited some money and am considering starting up a software house for the TRS-80, but have no real knowledge on how to do this. In particular, I require information as follows:

1. The initial cash outlay before I can start;
 2. The best way to obtain software;
 3. What copyright laws I am bounded by;
 4. What percentage royalties I pay;
 5. How I make such payments;
 6. The cost of advertising in PCW.
- D S Webb, Colwyn Bay, Clwyd

Starting any kind of business requires professional advice. Certainly much more than can be given in a brief answer such as this. There are several books on the subject of setting up your own business and I suggest that this might be as good a starting point as any. I am sure that you are probably quite an expert in your own field and would realise that you will need expertise in several areas other than the pure computing side.

You are bounded by all the copyright laws, the same as any other person/company in Britain, but the whole area of computer software copyright is shrouded in uncertainties. You should avoid situations that are morally wrong, such as changing a few statements in a program and calling it your own. There has been a recent case where someone produced a program that would enable users of Visicalc to copy their disks; this can seem innocent or far-reaching, depending on the way you look at it. You pay whatever commission you agree at the time — this is up to you and the program supplier — and you make the payments in any way that you agree. Write directly to the advertising department of PCW for current advertising costs.

SW

Which one

As a newcomer to computing I have decided that, to learn as much as possible about the subject, it is essential to have my own computer. Three machines appear specially suitable for the beginner: the Sinclair ZX80, the Acorn Atom and the Newbury NewBrain. Could you please comment on these and suggest which would suit a beginner best?

If I want to expand at a later date, would this be possible or should I think of starting with something like a Video Genie? Guy Kewney suggested in your February issue that there could be some delay on the NewBrain. Would it be better to wait for this, or choose some other machine now?

J A Priam, Exmouth; Jan Kalin, Ljubljana; and M Shroff, London

Taking the last point first — the microcomputer market is still in a state of rapid development and those who wait before buying will have a wider choice and quite likely lower prices. On the other

COMPUTER ANSWERS

hand, they will have let all that time go by when they could have been learning about computing 'hands-on'. And I do agree that's the best way to learn. So, if you can't get such practical experience at work, or from a school or college, and you've got about £150 to spare, you can get your experience at home; with the usual advantages of as much time as you like, and when you like.

There are at least two other computers to add to your list: the Sharp PC1211 Pocket Computer (or the Tandy version of it) and the Microtan. Of all these the Atom and Microtan offer ready scope to expand in steady stages to much more powerful systems with printers and disk drives. The NewBrain's spec probably offers scope for expansion, as it is very well provided with I/O features, the ability to cope with a lot of RAM, and with an inconvertible amount of ROM. But as yet there's no indication of when it will be available.

The Acorn has an unusual version of Basic — a strong point if you are a mathematician, a weakness if you want to learn Basic from it for later use on other machines. The ZX81 is a most intriguing item, having a number of features most helpful to the beginner, such as single key-stroke entry of many commonly used Basic keywords and instant syntax checking as each line is entered. The Sharp pocket computer is just that, a computer operating in Basic, which is about the size of, and cheaper than, many programmable calculators. The penalty for the small size and low cost is slow operation in comparison with the other machines in question.

As regards expansion, this can be done, as I've said, without going to the expense of a Video Genie, although at about £320 VAT paid, that is also very good value for money.

P L McIlmoyle

Chess despair

I am in despair! I bought a Tandy TRS-80 4k Level 1 with the aim of programming it to play chess — the rest I leave to your imagination! I'm now having it upgraded to 16k level 2, and would appreciate your help over how to program it for chess playing. I expect that I will need a Z80 machine editor/assembler and/or a T bug but would welcome your guidance. If I need extra RAM, is this easily and cheaply available for the TRS-80 as it is for the ZX80?

R W Edwards, Tamworth

You do not say in your letter whether you want to program your Tandy to play chess for the fun of the programming challenge, or primarily so that you can use it to play chess. If the latter is your real aim, then I am convinced that you would do much better by buying an effective chess-playing program ready-written rather than spending your money on system software. An effective chess-playing program represents many hundreds (if not thousands) of man-hours in writing it.

If you really want to go ahead with writing your own chess-playing program you will certainly want to use machine code for speed. So you should start by mastering the use of Z80 machine code on the TRS-80, using the USR function in level 2 Basic. Then the best bet would be to contact someone else working on the same problem.

Chess programs for the TRS-80 are available from A J Harding (Molimerx), from £14 to £26.

P L McIlmoyle

Trig calcs

Would you please give me the equations by which Basic or any other compiler calculates values for sine, cosine, tangent, logarithm, etc. Why is there no routine for calculating factorials?

Phillip L Watson

Most people are aware that there are series that approximate to the functions sine, cosine, tangent and logarithm; the series for sine is:

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots \text{ valid for all } x.$$

There are similar series for the other functions. However, there is a major drawback with such series — you may have to take dozens of terms to obtain the correct answer. What we require is a series that gives you the correct answer in only a few

terms. To get such a series we will have to accept a restriction on the range of validity for x ; this is not too much of a problem because functions such as sine repeat themselves anyway. Here is a series for sine:

$$\sin x = \sum_{k=0}^{\infty} a_{2k+1} x^{2k+1} \quad \text{ABS}(x) \leq \frac{\pi}{2}$$

where $a_1 = 1.000\ 000\ 002$

$a_3 = -.166\ 666\ 589$

$a_5 = .008\ 333\ 075$

$a_7 = -.000\ 198\ 107$

$a_9 = .000\ 002\ 608$

If you don't understand then ask a friend with a little maths knowledge (A-levels will do). If you were going to program it in Basic, then set up in an array values for $A(1)$ $A(3)$ $A(5)$ $A(7)$ and $A(9)$

then, using a loop, accumulate the sum as follows:

FOR K = 0 TO 3

T=T+A(2*K+1)*X↑(2*K+1)

NEXT K

PRINT "Sine of" X;"IS" T

I hope you get the idea. Notice that $\text{ABS}(X)$ must be $\leq \pi/2$; therefore, you will have to scale your values for x . Here are the series for:

$$\cosine x = \sum_{k=0}^{\infty} a_{2k} x^{2k} \quad \text{ABS}(x) < \frac{\pi}{2}$$

where $a_0 = 1.000\ 000\ 000\ 000$

$a_2 = -.499\ 999\ 999\ 942$

$a_4 = .041\ 666\ 665\ 950$

$a_6 = -.001\ 388\ 885\ 683$

$a_8 = .000\ 024\ 795\ 132$

$a_{10} = -.000\ 000\ 269\ 591$

$$\text{Tangent:} \quad \text{tangent } x = \sum_{k=0}^{\infty} a_{2k+1} x^{2k+1} \quad \text{ABS}(x) \leq \frac{\pi}{4}$$

where $a_1 = 1.000\ 000\ 002$

$a_3 = .333\ 330\ 82$

$a_5 = .133\ 397\ 62$

$a_7 = .059\ 358\ 36$

$a_9 = .024\ 570\ 96$

$a_{11} = .002\ 940\ 45$

$a_{13} = .009\ 473\ 24$

Natural logarithm (ln):

$$\ln x = \ln 2 \left[-0.5 + \sum_{k=0}^{\infty} a_{2k+1} u^{2k+1} \right]$$

valid for $2^{-35} < x < 1$

where $u = \frac{x - \text{SQR}(2)/2}{x + \text{SQR}(2)/2}$

$a_1 = 2.885\ 390\ 072\ 74$

$a_3 = 0.961\ 800\ 762\ 29$

$a_5 = .576\ 584\ 342\ 06$

$a_7 = .434\ 259\ 751\ 29$

Square root:

$$y = 0.25 * (w + x/w) + \frac{x}{(w + x/w)}$$

where $w = k(x+b-d)$

if $0.5 \leq x < k$

$w = k(x+b)$ if $k \leq x < 1$

where $k = 0.57155$;

$b = 0.75787$; $d = 0.013857$.

These formulae came from

Handbook for Computing Elementary Functions by L A Lyusternik, O A Chervonenkis and A R Yanpol'skii published by Pergamon Press SW

Our apologies to Mr L W Huson whose name was wrongly mentioned in connection with a Hewlett-Packard query (May PCW). Will helpful readers please stop writing to him.



'It must be all those diet programs you keep feeding into it.'

FREE!

to PET users

PRINTOUT

is the independent magazine about the PET, CBM & VIC computers. Each issue is packed with news, software reviews, programming articles, and tests of the latest peripherals. We are so convinced you'll want to subscribe that we're willing to send you a copy completely free of charge. Just mail us your address and the serial number of your PET, CBM or VIC.

To: **Printout Free Offer,**
P.O. Box 48, Newbury RG16 OBD.

Name: Serial No:

Address: Postcode:

Offer limited to UK CBM, PET and VIC users only. Expires July 31st 1981. Subscription rates: UK £9, Eire £IRL13, Europe £14 (air £18) USA \$35 (air \$45)

PCW.7.81



ZILOG'S Z8 FAMILY

Andrew Stephenson
takes an in-depth
look at a versatile
group of processors.

Few PCW readers can have failed to notice how busy every integrated circuit manufacturer of any size has been lately, bringing the benefits of VLSI to the masses. Meanwhile, largely hidden by the squads of glamorous 16- and 32-bit CPUs, some comparatively inconspicuous but very interesting microprocessors have been appearing, too.

For example, the Zilog range has quietly expanded: apart from the famous Z80 and the recent Z8000, there's now the Z8601. This has become the founder member of the potentially significant Z8 family of devices, of which 18 should be available by the time you read this. Since all derive from the Z8601, it seems sensible to examine that one first.

The Z8

The Z8601 is a true one-chip micro-computer, carrying enough ROM, RAM and I/O for quite demanding practical applications. In processing power it lies close to the Z80; though more 'byte-oriented' and lacking in automatically-repeating functions, it is more versatile in its architecture.

Its design has obviously benefitted enormously from the exercise which also yielded the Z8000. Many functions have been rationalised, especially those involving register operations. From the viewpoints of both the circuit designer and the programmer, it appears to have been soundly thought out. In no way should it be regarded as a 'cut-down micro'.

Unlike the Z80, the Z8601 is purely memory-mapped. Those 'ports' it does have are 'I/O channels' rather than logical entities manipulated by a separate addressing mode. As in the Z80, programs can extend to 64k but a distinction is drawn between 'program space' and 'data space' (my terms), so that, while 64k can be given over to program, another 62k can be given to data.

Of an internal file of 144 8-bit registers, no fewer than 124 are general-purpose accumulators for logical, arithmetical and test operations, in various addressing modes. They can even provide stack space. Sixteen of the remaining 20 are control and/or status registers, while the odd four are assigned to four ports whose 32 I/O lines can be reconfigured in many ways.

Mapped into the register space are several on-chip 'devices': a 'start-stop code' UART; two counter-timers connectable to various useful points

including external pins; the four ports, with handshaking on three if required; six prioritisable vectored interrupts from a choice of eight sources — two from the UART, two from the timer-counters, four from ports.

Memory

Users of devices such as the 6800 should have less difficulty in accepting the Z8601 than Z80 devotees, who may have to adjust to the totally memory-mapped I/O structure. More thought-provoking is the way the memory is divided up — see Figure 1.

Of the two major memory blocks, one is designed as being for program, although there are commands for moving register contents into and out of both areas with equal ease.

The lowest 2k of program is held in on-chip ROM. In the Z8601, this would be factory-programmed; other versions allow physically external but operationally internal ROM to be connected, a feature likely to endear the Z8 family to small-scale users. The device automatically copes with the physical difference between on-chip and off-chip program memory, crossing the boundary without programmer effort. This applies equally to the stack, which can occupy registers or off-chip RAM.

By contrast, external data movements have their own set of commands, owing to the distinction drawn between the internal register file and external RAM. Although register addresses run from 0 to 255 (with a couple of gaps), and may be thought of as slotting into a 2k non-addressable space at the bottom of data memory, they do not really form part of the data area.

The problems of applying the Z8601 to practical systems have clearly been thought through carefully. Although external memory costs some I/O lines, losses have been minimised by an ingenious choice of configurations which at first sight is bewildering, but soon reveals the underlying logic. More than one configuration is possible, according to how large the additional memory needs to be. There is no conflict between memory requirements and those of the UART, timers, etc. Again, the CPU copes with all off-chip addressing automatically — provided the right pins have been used, naturally!

Peripherals

There are approximately four classes of peripheral, discounting add-on memory. The possible configurations

are numerous but my impression is that Zilog has anticipated many real-life applications. Not only are the options useful but the handbooks do offer a clear description of how to achieve them.

Four 8-bit ports can be configured to provide a wealth of I/O options. In all respects — data, status, control — they are handled as part of the register file and can even be treated as accumulators in some cases. For the sake of clarity they are best summarised out of sequence:

- Port 3 provides four output lines and four input lines. These tend to be used for odd signals: handshakes for other ports, UART I/O, timer I/O, interrupt requests and so forth. Alternatively, the two nibbles can carry data.

- Port 2 is always available for any mix of 8-bit I/O, with or without handshake via port 3.

- Ports 0 and 1, loosely speaking, provide control and data lines for external memory, or they act as normal I/O, depending on the desired configuration. Port 0 gives two bidirectional nibbles, while port 1 gives one bidirectional byte. Again, these ports can be controlled by handshaking signals via port 3.

Each of the two 8-bit timer-counters has a programmable 6-bit prescaler. Both prescalers can divide the internal clock (running at one eighth the rate of the external 8 MHz supply) by any value from 1 to 64. If required, port 3 can drive one as a counter, as well as output an 'end-of-count' signal from either.

These choices, along with others which determine whether the timers loop continuously or make a single pass, whether they generate interrupt requests, whether they start or stop or restart and whether one of them provides the clock for the UART, are all set by software. Once started, the timers run independently of the CPU. The 8-bit counters (but not the prescalers) can be read safely at any instant.

Duplex serial I/O can run as fast as 62,500 baud without recourse to any off-chip hardware, although buffers would be advisable. The format supplied is the popular one start bit, eight data bits, two stop bits mixture, with the option of converting one of the data bits into an odd parity bit. Tolerance of frequency errors should be good because the receiver loses interest after only one stop bit.

Eight sources can generate requests for interrupts, of which up to six can be accepted and juggled into any of 48 priority orders, according to system

needs. All of this is controlled via registers.

Apart from the four edge-triggered port 3 input lines, requests can come from the UART ('receiver ready' and 'transmitter ready') and from both timers. Astute readers may be wondering how separate interrupts can arise from the UART and both of the timers, since one of the timers supplies the UART clock. Likewise, how can all four port 3 inputs give requests, along with the UART receiver? Answer: two pairs of those signals are mutually exclusive; one or the other of each has to be chosen, hence only six interrupts.

Interrupt vectors are held in the first 12 bytes of program memory. A simple procedure allows a choice between servicing interrupts sequentially, or allowing interrupts to be interrupted, although requests can also be polled.

'Softer' features

Given its instruction set, architecture, and 4 MHz internal clock, the Z8601 offers a serious challenge to the Z80. There are 231 command types. Zilog claims three addressing modes (direct, indirect, indexed) but the Z8's ability to address blocks of 16 registers, using a 'register pointer' and abbreviated addressing, is really a fourth.

If data already lies in a register — any working register — it can be operated on immediately, in combination with itself, or with constants, or with the contents of any other register. If the data lies in program or data memory, or must be moved out to either of those areas, simple 'load' commands will effect the transfer but there are no means whereby a move can be combined with value manipulation. However, since every register is an accumulator and all are equally well-endowed with processing abilities, this should inconvenience few users.

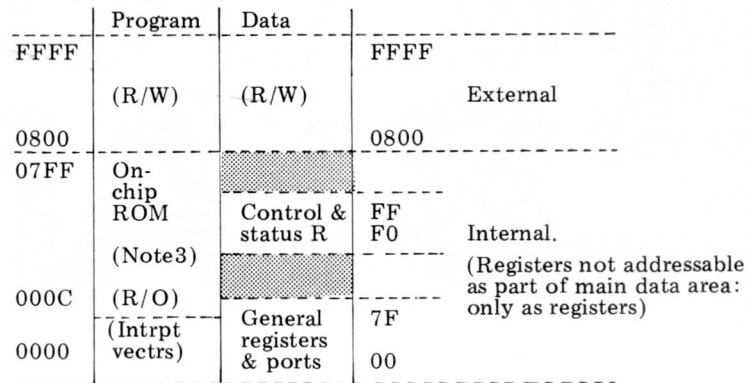
Value-altering commands include the fundamental arithmetical operations (add and subtract, with and without carry; clear; decrement and increment; decimal adjust; swap nibbles), logical combinations (and, or exclusive-or, complement, various rotations through carry, or not) and comparisons, along with two bit-masking tests which together outstrip the Z80 bit commands and of course there are the tests achieved using logical operations.

Although the Z8601 is as strong as most microprocessors on byte manipulation, there are only two commands for altering words: increment and decrement. Of course, this restriction is of no real consequence; any programmer worth tuppence an hour should be able to get around it.

More inconvenient is the lack of functions such as the Z80's LDIR, which will move a block of data by automatically-repeating transfers guided through pointers. The Z8 equivalents operate strictly across the division between registers and memory spaces and do no more than move a byte, then increment or decrement their pointers without repeating. There is also a lack of functions suitable for searching lists located outside the register space and none for automatic searches or strings for given characters. Minor though these nuisances are, they should be borne in mind.

The mention of a 4 MHz clock a few paragraphs up may not seem to jibe

It should be appreciated that the official Zilog view of how the data memory divides is that external RAM and internal registers form two separate areas. While true from the standpoint of the instruction set, the two do not overlap and hence are merged in the diagram shown here.



Notes:

1. 000C is the program origin after a reset.
2. represents gaps in the register file.
3. The 'on-chip ROM' is replaced in some UPC devices by 36 bytes of bootstrap ROM, enough to oversee the loading of program into off-chip RAM which thereafter behaves as on-chip ROM.

Fig 1 Z8601 memory map.

Device type	Pack type	Min qty	£/unit: batch	1-off price
CPUs:				
Z8601 standard	40 dil Plastic	3000	£7 : 3000	n/a
Z8602 2716 pins	64 dil Ceramic	1	£24 : 100	£34
Z8603 protopack	40 dil Ceramic	1	£37 : 100	£52
Z8681 ROM-less	40 dil Plastic	1	£7.50 : 100	£10
Z8611	4k, similar to [Z8601] [Z8612] — but uses 2732 (etc) [Z8613]			
Z8612				
Z8613				
Z8761 2k ROM Basic	40 dil Plastic	1	£23 : £100	£?
UPCs:				
Zxxx0 On-chip ROM	40 dil Plastic	3000	£13 : 3000	n/a
Zxxx1 4k ext ROM	64 dil Plastic	1	£55 : 100	£77
Zxxx2 4k ext RAM	64 dil Plastic	1	£55 : 100	£77
Zxxx3 ROM protop	40 dil Plastic	1	£55 : 100	£77
Zxxx4 RAM protop	40 dil Plastic	1	£55 : 100	£77

Table 1 Z8 Family: Rough price guide, March 1981

There are two main divisions:

Z859x series — meant for use with 8-bit host CPUs;
Z809x series — for use with 16-bit CPUs.
Further subdivision arises from the choice of program memory organisation. The Zxxx0 are similar to the Z8611, in having an on-chip ROM for the program. Two other types, Zxxx1 and Zxxx3, are analogous to the Z8612 and Z8613 in offering two ways of connecting off-chip ROM. The remaining two, Zxxx2 and Zxxx4, contain pre-set ROM and a bootstrap program which allows the host CPU to download the UPC's program into RAM on 'reset'.
Zxxx0 standard — on-chip ROM 40 dil
Zxxx1 4k external ROM — 2732, etc 64 dil
Zxxx2 4k external RAM 64 dil
Zxxx3 ROM protopack 40 dil
Zxxx4 RAM protopack 40 dil

The RAM types meant to fit the protopack devices are:

- 2k : MSM 2128, OKI Semiconductors;
TMS 4016, Texas Instruments;
HM 611 P, Hitachi, CMOS.
4k : Z6132, Zilog, quasi-static, JEDEC pin-out.

Table 2 Z8 Family: Universal Peripheral Controllers

with an earlier mention of 8 MHz. Zilog confuses this question with its own documentation, which remains the weakest part of the whole Z8 package. The clock need consist of no more than a crystal with two small capacitors wired to two pins. Alternatively, one pin may be driven from a TTL supply. Frequencies up to 8 MHz are acceptable and will be halved for general internal use.

Pipeline

Figures for execution speed are further complicated by 'pipelining', not a Zilog diversification into plumbing but a trick for cutting computation time. Although no longer brand new, the implementation of this idea in the Z8601 illustrates the quiet revolution which the Z8 series represents. The notion is simple in theory: when all the values needed for

one instruction have been obtained by the CPU, the next set is fetched and put into a 'pipeline' so it will be ready for immediate use on completion of the current task. Several instructions may be stored. By and large, the programmer can ignore all this extra activity, although occasionally there is need for special care. Most instructions require six or ten internal machine cycles, while the slowest of all takes only 20, so the overall speed is comparable to that of the Z80A on simple tasks.

Addressing

In the Z8 family the addressing convention employed by the Z80 is reversed, so that now the high byte of a word is stored below the low byte. Compare how the two would store the hex word ABCD at address 1000:

	Z80	Z8
@ 1000:	CD	AB
@ 1001:	AB	CD

This is not sheer perversity on Zilog's part. There are advantages to the 'new' convention.

Zilog admits to three addressing modes, then makes a separate fuss about a fourth. With due respect to Zilog, I shall lump them together; then I shall describe two more:

Register Pointer Mode permits abbreviated addressing and is available in the majority of instructions. The register file is divided into groups of 16 registers, each group being identified by the high nibble of its hex address. One of the housekeeping registers, number 253 (or FD hex), acts as a pointer to the current working register group, in that its high nibble is combined with the single nibble supplied by the instruction to create the exact address. Thus, if register FD holds 6A hex and the instruction gives the value 3 hex, the register pointed to for use in the operation is number 63 hex. Programs which can call standard routines without needing to calculate absolute addresses can operate far faster, so this feature is of considerable importance.

The other three modes are also widely available:

Register Addressing will be familiar to every programmer since one particular register is designated by number. Either the number itself may be given (eg 63 hex), or *Register Pointer Mode* may be used. Some instructions imply a pair of registers, whose contents are to be used in combination. For example, INCW RR10 results in the word held in registers 10 and 11 being incremented. In such cases, the address must be an even number.

Indirect Register Addressing causes the register (or registers) designated by the instruction to be read; then the contents are taken as the address (of a register or program instruction, as applicable). This applies to virtually every operation which requires an absolute address, including jumps.

Indexed Addressing is slightly trickier. The instruction yields two values; one is the address of a register whose contents are added to the other value to yield the address of the register to be used in the operation. This mode is also widely available.

The fifth and sixth modes hardly require more than a mention:

Direct Addressing is used only for jumps

and calls, where the exact target address is known.

Relative Addressing is the familiar form where the current program address is increased or reduced by the amount given in the instruction. This mode is confined to jumps and decrement then jump if non-zero.

Learning the language

The instruction set appears easy to learn, symbolically and functionally. Unhappily, Zilog has made a desperate mess of the notation used in its handbooks, in that there is a profoundly confusing inconsistency between assembler code mnemonics and the shorthand summaries given in the otherwise splendid instruction descriptions. For example, @RR in Assembler is the equivalent of R in Summary. Furthermore, r in Summary equals Rn (where n is a value between 0 and 255) in Assembler. How Zilog dared inflict this garble on the world is a mystery; it runs a very serious risk of having someone else 'take over' the production of the explanatory literature which ought to be kept firmly in house.

That said, the official assembler code is uncomplicated and closely related to that for the Z80. Sadly, there as yet appears to be no equivalent to the useful *Z80 Technical Manual*. The closest Z8 publication, similarly titled and paperbound, concentrates on hardware details and confines itself to a very technical summary of the instruction set. Though much of this information will certainly be needed by programmers, it is a bit much to ask them to spend a further considerable sum on the *Z8 PLZ/ASM Assembly Language Programming Manual* of which only a minor part is given over to (excellent) explanations of instructions and mnemonics.

Current commercial situation

Eighteen versions of the Z8 already exist, many of them package variations aimed at different sorts of users. Table 1 gives a current general price guide for 100-off and one-off quantities other than devices factory-programmed to order.

Z8601 is the standard version, described above. Being factory-programmed, it will probably only appeal to large users. Like the majority of the family, it is supplied in a 40-pin DIL pack, in both ceramic and plastic versions.

Z8602, a 'development device', is functionally identical to the Z8601 and is supplied in a 64-pin pack whose pin-out resembles that of the Z8601. The 24 extra pins are direct connections to external ROM, such as the 5V 2716, and require no buffering. Because of these extra lines, up to 2 kbytes of program cost no I/O, although additions beyond this limit do, as does data memory.

Z8603 is a 'protopack' device intended for development applications where the pack must mimic the Z8601 as far as possible, even to board layout. To achieve this, it has a piggyback socket for a 2716 EPROM.

Z8681, called the 'ROM-less Z8', is a

many applications will require off-chip memory anyhow, this device comes with just enough pre-set program to configure it for external memory. Thereafter, the user's software takes over. It is cheap, does everything a Z8601 with external memory will and should appeal to small users.

Three more types differ from the 2k Z860x series by containing 4k of ROM: Z8611, Z8612, Z8613. Obviously, there is no 'ROM-less' version here.

Derivatives

Zilog would have been foolish not to capitalise on the Z8's potential as a stand-alone controller of peripherals. Accordingly, it has produced ten 'Universal Peripheral Controllers'.

Every member of this sub-family is virtually a Z8 with one less port, no UART, no 'externally-addressable' memory, an enlarged file (256 registers) and a very nice ability to chat to the CPU over an 8-bit bus (Zilog's own 'Z-bus' — very simple, very logical, easy to use, reminiscent of 6800 protocol). The CPU can be allowed two-way access to any number of registers, thereby speeding data exchange but if necessary the UPC can pull up the drawbridge and sulk. Some versions allow the CPU to load the UPC's program after a reset; RAM is substituted for ROM, the wiring differs slightly but otherwise all is the same. The main line of division lies between UPCs intended for use with the Z80/8080, etc (Z859x series), and those for the Z8000 (Z809x series). See Table 2 for details and rough prices.

Specials

Obviously, the Z8601 can be pre-programmed to do virtually any task appropriate to a small microprocessor. Again, Zilog has seized the advantage and has produced the Z8671, pre-programmed with a monitor and Basic, all in 2k.

However, though the Z8671 appears to be on sale, the information available is still 'preliminary'. Zilog spent about 30 minutes digging through a handbook 'half an inch thick', then said enough for me to guess that it's an unsurprising but possibly useful/amusing integer Basic. Otherwise the Z8671 is a normal Z8601, so can access additional external program. Clive Sinclair and his imitators could soon be selling one-chip computers, never mind these bulky ZX81s!

Future developments

One could speculate endlessly on what might be done with the Z8 and its derivatives. Among the tangible developments which can now be mentioned are faster versions of all these devices, probably to be identified by the suffix 'A', which will have a maximum external clock speed of 12 MHz. On byte-level tasks this should push the Z80A firmly into the league below and even the Z80B will have to look to its laurels.

The outcome of such 'contests', of course, depends on those who find applications for this new family. People like you, the reader.

Our thanks to Zilog (UK) Ltd for its help in the preparation of this article.

Comart Approved**Dealers****Belfast**

O & M Systems
95 Dublin Road
Tel: 0232 49440

Birmingham

Byteshop Computerland Ltd
94/96 Hurst St, B5 4TD
Tel: 021 622 7149

Cambridge

Cambridge Computer Stores
1 Emmanuel St, CB1 1NE
Tel: 0223 68155

Cornwall

Benchmark Computer
Systems Ltd
Tremena Manor
Tremena Road
St Austell, PL25 5GG
Tel: 0726 610000

Dublin

Lendac Data Systems Ltd
8 Dawson St
Tel: 0001 372052

Glasgow

Byteshop Computerland Ltd
Magnet House
61 Waterloo St, G2 7BP
Tel: 041 221 7409

Leeds

Holdene Ltd
Manchester Unity House
11/12 Rampart Road
Woodhouse St
Tel: 0532 459459

London

Byteshop Computerland Ltd
324 Euston Road
London W1
Tel: 01-387 0505

Digitus

9 Macklin Street
Covent Garden WC2
Tel: 01-405 6761

Jarrologate

67 Tulsemere Road,
West Norwood,
London SE17
Tel: 01-670 3674

Manchester

Byteshop Computerland Ltd
11 Gateway House
Piccadilly Station Approach
Tel: 061 236 4737

NSC Computers

29 Hanging Ditch
Tel: 061 832 2269

Newbury

Newbear Computing Store
40 Bartholomew St
Tel: 0635 30505

Nottingham

Byteshop Computerland Ltd
92A Upper Parliament St,
NG1 6LF
Tel: 0602 40576

Sheffield

Hallam Computer Systems
451 Eccleshall Road, S11 9PN
Tel: 0742 663125

Southampton

Xitan Systems
23 Cumberland Place,
SO1 2BB
Tel: 0703 38740

Sudbury

Eurotec Consultants
Holbrook Hall
Little Walsingham
Tel: 0206 262319

Warwick

Business & Leisure
Microcomputers
16 The Square
Kenilworth
Tel: 0926 512127

Watford

Lux Computer Services
108 The Parade
High Street
Watford WD11 2AW
Tel: 0923 29513

Comart Microcomputer dealers
are located strategically
throughout the country to give
support, guidance and
assistance. In the event of
difficulty contact Comart direct.

 **Cromemco**

Flexibility + Versatility

System Flexibility

Cromemco give you the high performance, reliable computer power you need now, with the in-built capability for future expansion and adaption as demands and requirements change.

The choice is wide. Cromemco's S-100 bus construction provides for expandable memory capability and the widest choice and future options in peripheral support.

Now there is the exciting range of Cromemco High Resolution Colour Graphics Systems.

Applicational Versatility

Cromemco's CDOS Operating System supports proven, well documented Software for Business, Industry, Science, Research and Education; COBOL, RPG II, Macro Assembler, 16K and 32 BASIC, FORTRAN IV, LISP, RATFOR, Word Processing and Data Base, are all included in the range.

Now, there is the new CDOS compatible, Cromix Multi-user Multitasking Operating System which opens up new avenues in application and performance for Cromemco System Users.

The U.K. Leaders in Microcomputer
Development, Application and Support.

comart

PO Box 2, St Neots, HUNTINGDON, Cambs
Tel: (0480) 215005 Telex: 32514 Comart G.



Computer games

I've been speculating recently on what it is that makes a good computer game and I thought that, with so many of you sending in programs, you might be interested in my conclusions.

At first sight, there doesn't seem to be much connection between games other than the fact that they're played on a computer. For instance, what possible points of similarity are there between — say — Space Invaders on the one hand and Adventure on the other? Space Invaders is all real-time graphics while Adventure has no real-time element and is all text.

Instead of looking directly at the problem of what makes a good computer game, however, it helps if we look at and analyse those computer games that are not so good — are there elements that we can say detract from their value?

Yes, I think that there are and if you thought about it for a bit, you might come up with similar answers.

One thing that poor games do not do is involve the user enough. There have been several very clever games that have gone across my desk that were minor miracles of programming but when you ran the programs there was little for you to do except sit back and admire. This is a game? Nobody wants a game like that; we want to be doing something — participating — making things happen. Space Invaders does that, all right — every split second.

Many games lose their interest after about 30 seconds because they are too easy. They conjure up the image of Charlie Chaplin yawning and casually polishing the fingernails of one hand while bopping a queue of blundering idiots who persist in charging through a certain door — they never learn and knocking them down gets boring. To be successful, a game has to present a real challenge.

There are challenges and challenges, of course. A game that is challenging for an adult might be so incomprehensible to a child as to be pointless. (I know of no child who is as hooked on running the economy as I am!) The age-range aimed at must therefore be clearly thought out — and a game that will appeal to all ages is about as common as snowballs in the Sahara. This is true for any kind of game, not just those run on a computer.

These thoughts help to get us started. One thought that came to my mind was that good games have a bit of a 'bite'. That is to say, they're a sort of stylised

warfare in which you do your damnedest to do down the other fellow without lasting damage. Take Monopoly, for instance, the biggest success story among modern games. Or chess, among old games. You 'do' your opponents and you feel cross or self-critical — or murderous! — if you lose.

I think that good computer games have this element, too. In Space Invaders, I suspect that most players are not murderous towards the little jiggling, stupid, advancing green men. No — I suspect that players have in the forefront of their minds their mate's best score, and it is this they are trying to better — and through it, him/her.

I can accept that many people won't feel this way but are simply bettering their own scores, in which case, the person they are trying to 'do better than' is themselves. They are trying to improve some skill — which brings in the next important element of a good game. Does it exercise some skill? Can you get better and better at the game, or does it rely too much on chance?

A good test of this skill factor is to enquire if you can do worse if you deliberately neglect to exercise your skill. I throw this one in because one computerised version of Dungeons and Dragons I saw upgraded the player as he progressed through the game, to such an extent that he was virtually invincible. We're back to that image of Charlie Chaplin again. The program writer wrongly thought of increased skill as a reward rather than something earned and maintained by effort, something unique to the player.

Lastly, D & D reminds me that there is an element of imagination or even fantasy in a good game. I don't think this needs stressing, as most people are well aware of it and indeed, it is probably the most obvious point of all.

There we are, then — my recipe for a good computer game: 1. Involve the player as much as possible. 2. Give the player a real challenge. 3. Give the game a bit of a bite — the chance to do opponents down, even if the opponent is yourself or the computer. 4. Involve the exercise of skills — manipulation, thinking, observing, analysis, computation — anything at all. 5. Exercise the user's imagination in some way.

Now you should all be able to write superb games programs and send them in to PCW when you've done it! (How's that for a challenge and the exercise of skills?)

Programs received

Decimal-to-Binary Converter and Noughts and Crosses (Hewlett Packard 9830A), by Michael Bissett (15) of Glenrothes, Fife.

Space Wars (TRS-80) by Richard Acland (13) of Colchester.
Die Rolling/Betting (ZX80) by Adam Brown & Simon Holmes of Bicester.
Maze for PET, by A Esmond (14) of Scarborough.
Pontoon for ZX80 by D J Ford (12) of Chepstow.

Drawing on TRS-80 by Robin Gardner (14) of Bedford.
ZX-80 Maths Test, by Stephen Bootes of Hartwell, Northants.
Random Lines (TRS-80) by Mark Claydon (15) of Harrow.
Breakout (Microtan 65) by Peter Simpson of Wivenhoe, Essex.

Well done, all of you! You can't send too many.

Commercial break

Do you suffer from lost tapes, falling programs or misplaced letters? Then you must try the new miracle ingredient — addressing! Tested by the British Dental Association, addressing keeps your tapes and letters intact, restores them to former vitality and keeps you happy. Nine out of ten cats prefer it.

End of break

Would the author of the ZX-80 Adventure Maze please write in? I don't have your address. Oh, and would you all please put your name and address on your tapes *as well as your letters*? It gets to be quite a headache matching one with 'tother. Thanks a bunch!

Mugtraps

My Mugtrap Award this month (a stupendous book-token) goes to Richard Vernon (15) of Uxbridge, who sent this in for the Acorn Atom:

```
220 (end of main program)
221 P.$21
230 (JSR #FFE3;STA #81;RTS;)
235 P.$6
240 P."WOULD YOU LIKE
    ANOTHER GAME"
250 P."HIT KEY Y OR N"
270 LI.#82
280 IF ?#81 = CH"N" T.E.
290 IF ?#81 = CH"Y" T.RUN
300 P.$7;G.250
```

That's nice. If you can follow Acorn's peculiar Basic, you will see that the mug does not have to press RETURN at the end of a program. He just taps Y or N, but if he does neither, he is looped to line 250 over and over until he does.

A little reminder to all of you that I'm interested in mugtraps and I'll give book-tokens for any published on this page. Roll 'em in! This is a terrific way that we can all learn from each other.

PATTERNS

Alan Sutcliffe continues his thought-provoking series.

Generating patterns is intrinsically satisfying, but it also has many applications. I find it particularly pleasing to enumerate all possible patterns of a particular kind. This is also useful in the analysis of many games and pastimes. Having written in the last two months about ways of generating complete sets of patterns, I am now going to turn to their use in the study of games.

State diagrams are the subject of this article. In the first half I give some examples of their derivation and use and in the second part some programs are presented for manipulating state diagrams. This is interspersed with some general remarks.

Any game that can be played on a computer can only have a finite number of positions or states. This number may be very large and unknown (as in the game of chess) but nevertheless limited. The number of different positions in chess is certainly less than 65^{35} , since each of the 32 pieces must be on one of the 64 cells or off the board. This is a gross overestimate, since no two pieces are allowed to be on the same square. A somewhat better upper limit is $65!/33!$ although this counts pawns as distinct. Some other restrictions are also ignored, such as impossible positions and symmetrical cases. There are at least $64!/50!$ different positions — the number of ways of placing one piece of each kind and colour on the board. But the numbers hardly matter: the point is that they are finite.

Many other games have a more modest number of possible positions but even for quite simple games the number can be fairly large. In noughts and crosses, for example, even allowing for rotations and reflections, there are many hundreds of different states that can occur in the course of a game.

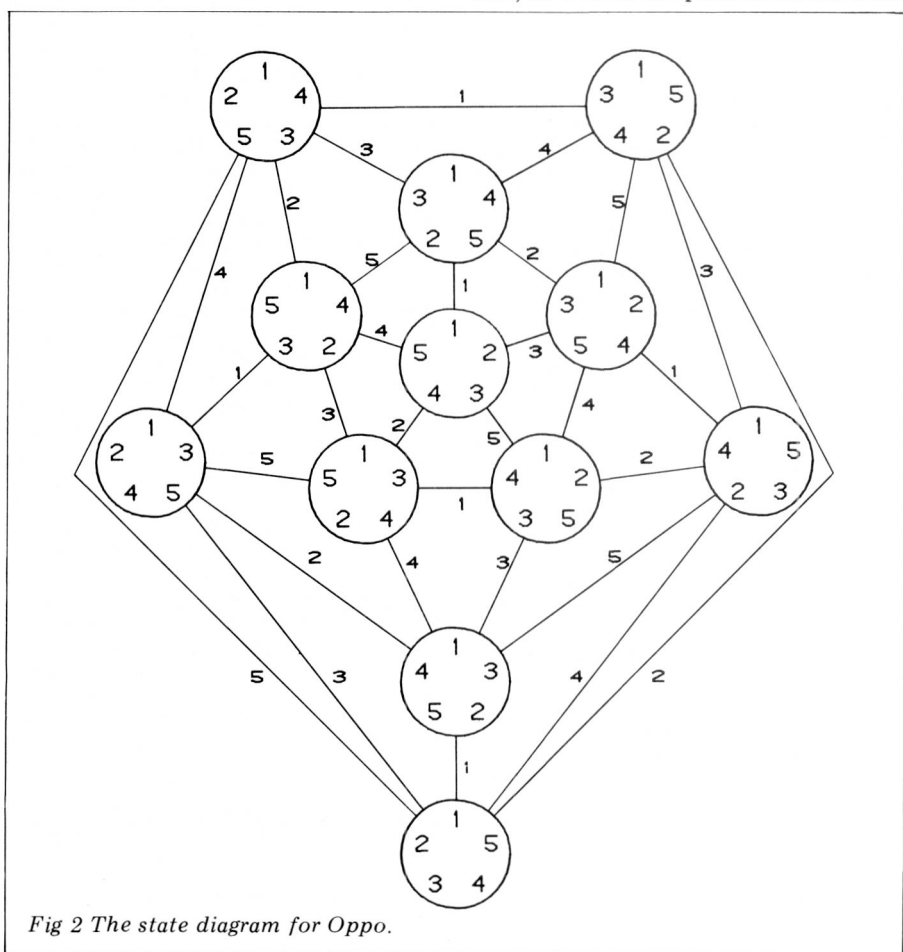
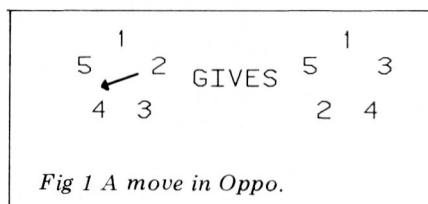
A state diagram is simply a list of all the possible positions that can arise in a game or other activity, together with details of all the links that lead from each position directly to the next. A path through a state diagram is a series of one or more links from one position to another. If the diagram represents a game, then one complete instance of playing the game will be represented by a path from the starting position to an end position. I will illustrate the use of a state diagram to solve a little puzzle that I call Oppo.

Oppo is played with five numbered counters arranged in a ring. A move consists of taking any counter and moving it to a position at the opposite side of the ring, as shown in Figure 1. The order of the counters round the ring is all that matters, not their exact location: the counters do not fit into fixed cells. For convenience, arrangements will always be shown with 1 at the top. The following questions can now be asked and answered:

- 1) From a given starting position, is it possible to reach all the other positions?
- 2) Of those that can be reached, what is the fewest number of moves needed to get to each and, in particular, which position is furthest away, having the longest minimum path to it?

The first job is to list all the possible positions. These are simply all the cyclic permutations of the digits 1 to 5. There are just $4! = 24$ of these, since 1 may be taken arbitrarily to be in the first place followed by all the arrangements of the remaining counters.

The second task in deriving the state diagrams is listing all the links from one position to the next. In each state of Oppo there are just five possible moves: one for each of the five counters. This listing may be done in an organised way simply by taking the states in order and noting for each the states to which it can lead in one move. The result is



shown in Figure 2.

This can be seen as an icosahedron, one of the five regular solids of Euclid. It has 12 vertices and 20 triangular faces. Inspection of the diagram allows us to answer the questions asked above:

- 1) From any position, only 11 other positions can be reached. The remaining 12 positions form a disjoint set with an exactly similar state diagram;
- 2) Of the 11 positions, five can be reached in one move and another five are two moves away. The final position, which is an exact reversal of the first and at the opposite vertex of the icosahedron, can be reached in three moves.

There is nothing special about the arrangement 12345 that we have chosen to start with, except the way we happen to have numbered it. Each of the other positions is equivalent. The regularity of this state diagram is attractive; notice that there are just 20 ways in which the sides of a triangle may be numbered with the digits 1 to 5, all the digits different on a triangle; each of these 20 ways occurs just once when each link of the diagram is numbered with the counter that is moved.

Here is an elaboration of Oppo that you may care to analyse. Call it Poop. The five counters are now placed in the frame of a rectangular 2x3 grid, as shown in Figure 3. Any counter immediately next to the empty cell may be moved into it. In the example shown 1, 3 or 5 may be moved. If one of the corner cells is empty, then only two moves are possible. Arrangements which differ only by rotation through 180 degrees, like those in Figure 3, are considered identical. There are no other symmetries to be discounted.

The state diagram is very much bigger. Since absolute position now matters, as well as the position of the blank

2	3	4		5		1
1		5		4	3	2

Fig 3 Identical positions in Poppo.

cell, there are $24 \times 3 \times 5 = 360$ different states. But the state diagram is still very regular: it is shown in Figure 4, with a close-up of a portion of it in Figure 5.

There are two essentially different kinds of move. When a piece is moved between the two middle cells — as in the move of 3 in Figure 3 — the cyclic order of the counters is altered, as with moves in the first puzzle. For all other moves the cyclic order of the counters is not changed; a counter is simply moved one place round the perimeter of the board.

The states thus fall into groups of 15 which all have the same cyclic order. Each single state in the Oppo diagram is replaced by such a cycle of 15 states. At every third state round each cycle, a move is possible into another cycle, corresponding to the moves in Oppo. The whole state space again falls into two disjoint parts, now with 180 states in each part: 12 cycles of 15 states. It can take up to 21 moves to get from one state to another in Poppo.

Consider the following game for two players: starting from any position, the players move alternately; a move is defined as before; the first player to move into a position already used loses (Pooped).

There are two distinct ways to play the game — let's call it Poppo. The first is using a box of six cells and five counters, writing down a list of

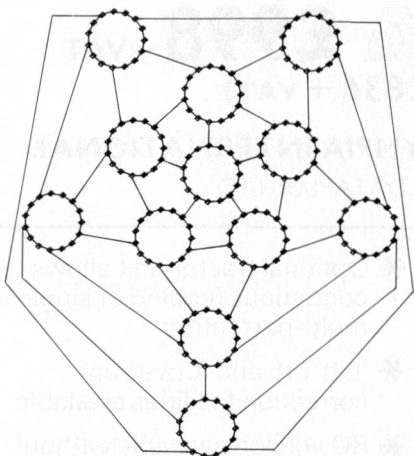


Fig 4 State diagram for Poppo.

positions used as the game proceeds, so that any repetition can be noted. The second is to trace out the route of successive moves on the state diagram. The two methods give two entirely different views of what is logically the same game. In the first it is very difficult to see ahead and to remember the positions already visited. In the second, the past, present and future of the game are all relatively easy to see. The difference is like that between navigating an unknown maze with only pencil and paper and going round it with a map and compass. The game, if it does

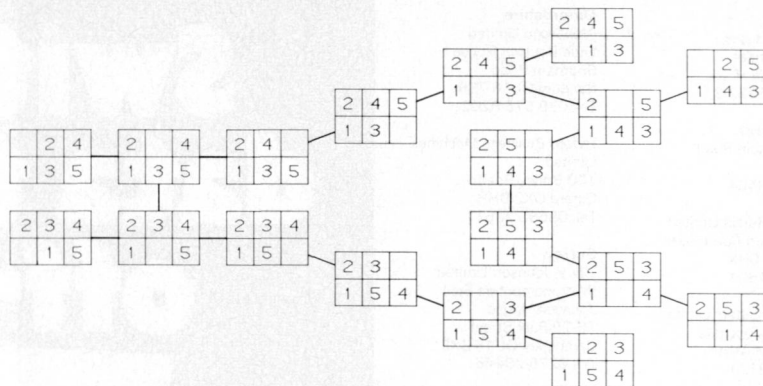


Fig 5 Part of the state diagram for Poppo in detail.

not altogether lose its interest, certainly loses its mystery.

Notice, however, that the state diagram we are traversing is not the state diagram of the game Poppo but of the puzzle Poppo, as shown in Figure 4: call it S_0 . This has become the game board for Poppo, which has a far more complex state diagram, say S_p . Each state in S_p represents a path in S_0 from the chosen starting position to some other position. S_p has as many states as there are paths in S_0 from a given cell to any other cell without visiting any one twice. Plus, to be accurate, one state for each path in S_0 that ends with the one repetition that terminates the game. State diagrams can always be used as a game board in this way, with an order of magnitude increase in the level of complexity. Since the aim of describing Oppo was to give a simple example, I will leave further investigation of this proliferating example to you and turn to another game with a less regular state diagram.

It is a simple game of the Nim type — let's call it Min. It is played with eight counters, set out initially as in Figure 6 on the corners and sides of a square. The rules of Min are: there are two players who move alternately; a move consists of removing one, two, or three counters with these conditions — any single counter may be removed, any two counters not part of a part of three counters in a line may be removed, any three counters in a line may be removed. The player who takes the last counter wins.

There are 17 different possible states of the board in Min, including the final empty board. I have enumerated these by hand and they are shown in Figure 6. Many arrangements with different appearances are identical as far as the rules of Min are concerned. State E in Figure 6, for example, consists essentially of three counters in a line plus any other three counters that do not form another line of three, either by themselves or with one of the counters in the first three.

There are $2^8 = 256$ apparently different states which reduce to the 17 cases given. Figure 6 also shows the links (moves) between states. There are two main ways in which the information in this state diagram can conveniently be coded into data for a Basic program. In the first method, for each state there is a list of states to which it can lead in one move. The last state should be marked as win, lose or draw for the player to reach it. In the second method, the information is

coded into a matrix with one row for each state as a destination for a link. Notice that links are directed and A to B is not the same thing as B to A. Figure 7 shows part of the data for Min in the first form and the whole matrix for the second method is shown in Figure 8.

The first method has the advantage of needing less space than the second. The code needed to process it is a little more complicated, but in the second method time is wasted inspecting empty cells in the matrix. The second method has the advantage that it can be read both forwards and backwards, while the lists only give the forward links explicitly. All these factors should be considered in choosing the method to be used in a particular case, together with the constraints of the particular machine. If the state diagram is dense with links — many or most states can be reached from a given state — then probably the matrix is preferable, but if the matrix of links is sparse then the system of lists is likely to be better.

I shall now detail some useful processes that can be applied to the state data. The first is to find the total number of possible games. Program A gives this for the matrix data. The algorithm goes like this: establish a count for each state and set all these counts initially to zero. There is just one partial game for the initial state: the board set up and no moves made. Set the count for the initial state to 1. For each state which has had its count computed, starting with the initial state, add its count to the count for each of the states to which this state directly leads. When this has been repeated for all the states, the total number of games will appear as the count for the final state.

This method also works when there are several starting positions or finishing positions. Care must be taken to ensure that all the links leading to a state have had their count added to its count before that is added to those of its successors. Program A does not check for this but assumes that the states are in order of their occurrence in the game. This is easily achieved in any game like Min where one or more of the counters are removed from (or added to) the board at each move until some limit is reached. Simply list the states in order of the number of counters present. All Nim games are in this category as well as many cards games, such as whist, where a card must be played at every turn. Noughts and crosses has the same property, as does Othello or reversi. There cannot be a

LOCAL DEALERS

LONDON

Belmartin Services
194 Union Street
London SE1 0LH
Tel: 01-928 5322/3

Eurocalc Limited
128/132 Curtain Road
London EC2
Tel: 01-739 6484

Lion House (Retail) Limited
227 Tottenham Court Road
London W1P 0HX
Tel: 01-637 1601

Personal Computers Limited
194-200 Bishopsgate
London EC2M 4NR
Tel: 01-626 8121

PROVINCES

Avon

Decimal Business Machines
Limited
Decimal House
Thomas Lane
Bristol BS1 6JH
Tel: 0272 214093

Berkshire

The Computershops Group
7-9 Gosbrook Road
Caversham
Reading RG4 8BD
Tel: 0734 481008

Buckinghamshire

Chiltern Microcomputers Limited
7 Amersham Hill
High Wycombe HP13 6NQ
Tel: 0494 20416

Cheshire

McNab and Company
27 Sunfield
Romiley SK6 4PJ
Tel: 061 494 9410

Cornwall

Diskwise Limited
25 Fore Street
Callington PL17 7AD
Tel: 05793 3780

Exleigh Business Machines Limited

11 Market Place
Penzance TR18 2JB
Tel: 0736 66577

Hertfordshire

CCS Microsales
7 The Arcade
Letchworth SG6 3ET
Tel: 04626 73301

Greater Manchester

Executive Reprographics &
Business Consultants Limited
2/4 Oxford Road
Manchester M1 5QA
Tel: 061 228 1637

Merseyside

Currie (Business Equipment)
Limited
8 Upton Road
Claughton
Birkenhead L41 0DF
Tel: 051 658 5111

Norfolk

Anglia Computer Centre
88 St. Benedicts Street
Norwich NR2 4AB
Tel: 0603 29652

Oxfordshire

Alphascan Limited
Little Bourton House
Southam Road
Banbury OX16 7SR
Tel: 029 575 8202

Hyford Business Machines Limited

120 Botley Road
Oxford OX2 0HH
Tel: 0865 723511

Surrey

T & V Johnson Limited
(Microcomputers Etc.)
Johnson House
75-79 Park Street
Camberley GU15 3XE
Tel: 0276 20446

Warwickshire

Business and Leisure Micro
Computers
16 The Square
Kenilworth CV8 1EB
Tel: 0926 512127

Gallid Limited

1 Bilton Road
Rugby CV22 7AA
Tel: 0788 74442/3

West Midlands

Camden Electronics Limited
462 Coventry Road
Small Heath
Birmingham B10 0UG
Tel: 021 773 8240

C.P.S. (Data Systems) Limited

Arden House
1102 Warwick Road
Acocks Green
Birmingham B27 6BH
Tel: 021 707 3866

Worcestershire

Arrow Business Computers
Limited
Royal House
11 Market Place
Redditch B98 8AA
Tel: 0527 62733

Yorkshire

Saville Audio Visual Limited
Salisbury Road
York YO2 4YV
Tel: 0904 37700

SCOTLAND

Strathclyde

Turnkey Computer Technology
Limited
23 Calderglen Road
St. Leonards
East Kilbride G74 2LQ
Tel: 03552 39466

Video Vector Dynamics Limited

39 Hope Street
Glasgow G2 6AE
Tel: 041 226 3481/2

WALES

South Glamorgan

David Potter Office Equipment
Limited
164 Richmond Road
Cardiff CF2 3BX
Tel: 0222 496510

West Glamorgan

Croeso Computer Services
516 Mumbles Road
Mumbles
Swansea SA3 4BV
Tel: 0792 60624

Switch this data terminal off-line...



...and you've got a daisywheel typewriter.

SCRIPTA £998 + VAT
(RO Version £836 + VAT)

Manufactured in W. Germany by **OLYMPIA INTERNATIONAL**

SOLE UK DISTRIBUTOR: DATAPLUS LTD.,

- * Does the work of both a data terminal and an electronic typewriter.
- * Saves you hundreds of pounds in machine costs.
- * Full word processing capability.
- * Library of easily-changed daisy typewheels.
- * Optional tractor unit allows continuous feeding of single or multi-part forms.
- * 'Lift-off' and 'Cover-up' correction facilities available.
- * RO version available without keyboard.
- * Contact your nearest dealer or the address below for more detailed information.

DATAPLUS

DATAPLUS LTD.,
39-49 Roman Road, Cheltenham GL51 8QQ.
Telephone 0242 30030 or 37373. Telex: 43594

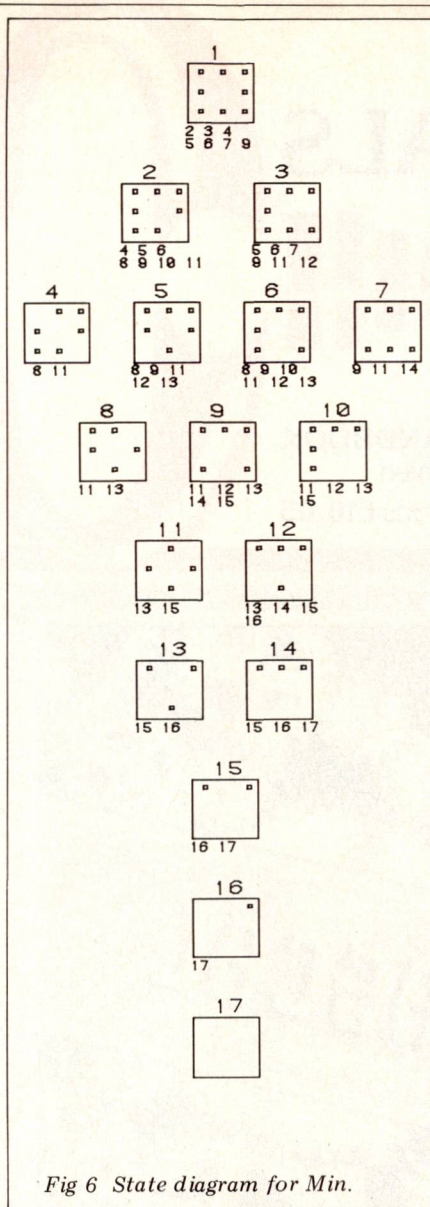


Fig 6 State diagram for Min.

link between two states with the same number of pieces played.

This property also ensures that another condition is met which is necessary for the number of games to be finite and therefore countable. That is that there be no loops in the state diagram and no sequence of links that loads from a state back to itself, so that no state may be repeated in a particular game. Since infinite games are hard on the players, any game with loops in the state diagram should have a limiting rule. In chess, this is that the game ends on the third visit to any state.

Beggar-my-neighbour is a game that looks as though it can go on for ever, though it seldom does. With some limited packs of cards, there is a loop in state diagram. Suppose that the first player has nnJn and the second has just Jn, where J is a Jack and n is any number card from 2 to 10, and it is the first player to play, these cards being face down from the top. Then, after three cards have been played, the position will be reversed, Jn against nnJn, to play. The game will thus continue to oscillate between these two states indefinitely. I am not sure whether this can happen with a full pack of 52 cards initially divided equally, which is the usual way the game is played. Beggar-my-neighbour has an unusually simple state diagram. For any

Number of links	Links
1	7
2	7
3	6

I N(I) V(I,J)

16	1
17	0

Fig 7 Part of the state diagram for Min as lists

initial allocation of the cards there is only one possible game. The sequence of moves is entirely determined, since each state leads to only one other state. The interest is in the unknown, though predetermined, outcome of each game.

Now we come to the most important part of game analysis: how to win. In any game, like Min, for which the state diagram is known and the outcome is always a win for one player (no draws, ties, or stalemates), it is always possible for one player to ensure a win, whatever the other player does. To find out how to do this means establishing each state of the game as Safe or Unsafe for the winning player.

Safe (for the player) means a position from which the opponent must always move to an Unsafe position. Unsafe (for the opponent) means a position from which the player can always move to a safe position. Which state is which is determined by starting at the end and working backwards through it.

It is as though the state diagram is divided into small safe islands surrounded by an unsafe sea. The islands are so spaced that, stepping from one island, the opponent cannot reach another in a single move, but must land in the sea. And from any such position in the sea, the player can always get to the next island. The final position in Min is Safe: landing there ensures a win. Thus,

FROM	TO									
	1	2	3	4	5				16	17
1	0	1	1	1	1				0	0
2	0	0	0	1	1				0	0
3	0	0	0	0	1				0	0
						M(I,J)				
16	0	0	0	0	0				0	1
17	0	0	0	0	0				0	0

Fig 8 Part of the state diagram for Min as a matrix

any state with a link to it is Unsafe. The next step backwards is to find any Safe state, ie, any state that is linked only to states already categorised as Unsafe. Given a set of Unsafe positions, as just found, there must be at least one Safe state which is linked only to them. This is true under the conditions already given and provided that the state diagram is finite. This process is repeated for further generations of Unsafe and Safe states until the starting state is reached. If this is Safe then the first player to play can always win and if it is

Unsafe the second player can always win.

Program B takes the state diagram for Min and determines the Safe and Unsafe states. It can easily be adapted for other state diagrams.

In more complex games there may appear to be many starting and ending positions, but this can be simplified. There is only one starting position, the blank board. If the first player has the choice of initial position, this is taken as the first move, even though it may be different in kind from the other moves. There are only three end states: first player wins, second player wins, and drawn game. In noughts and crosses, for example, there are many distinct states which count as a win for 0, the first player. Introduce a nominal last move for X, the losing move, which consists, say, of changing all Xs to Os. This is then the one state to which all the losing states for X lead. It counts as Unsafe (for X) so that all the states leading to it, the normal end states for the game, become Safe (for 0). All the winning states for X can be treated in the same way, and a third new end state introduced to tie together all the end states corresponding to a drawn game.

To determine the game, first trace the Safe/Unsafe states back from the 0-wins state, using the method given above. If the process reaches the start state then 0 can always win whatever X does and no further analysis is needed. But it may be that the process will peter out: at some stage from a set of Unsafe positions there will be no Safe position which leads only to Unsafe ones. 0 cannot win such a game, assuming that X always plays as well as possible. In this case repeat the analysis, starting with the X-wins state. This will show either that X can always win, or that the game must end in a draw, given as always that both players adopt the best strategy.

Another use for state diagrams is in programs that learn to play a game. For each move between two states there is a weight which gives the relative probability of choosing that move from the possible ones from that position. Thus, the matrix of weights has the same dimensions as matrix of moves (or as the lists of moves, if that method of representing the data is being used). Each time it is the computer's turn to move it selects at random from the possible moves according to the weights. Initially, all the weights are set equal, so that the computer plays entirely at random. Even when it is only one move from winning, the program does not prefer the winning move above the other possible moves. In that sense, it knows nothing about how to play except what moves are allowed.

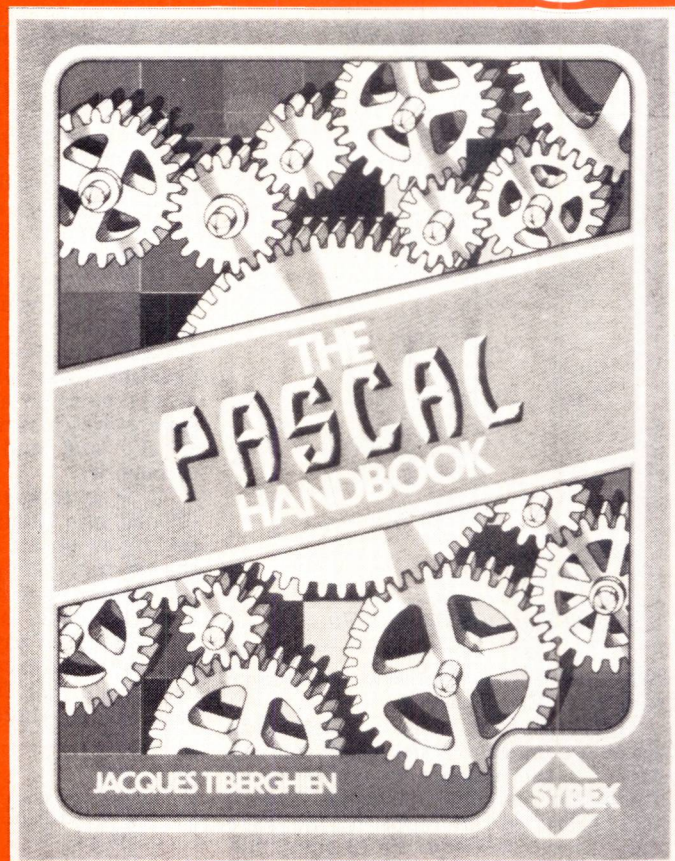
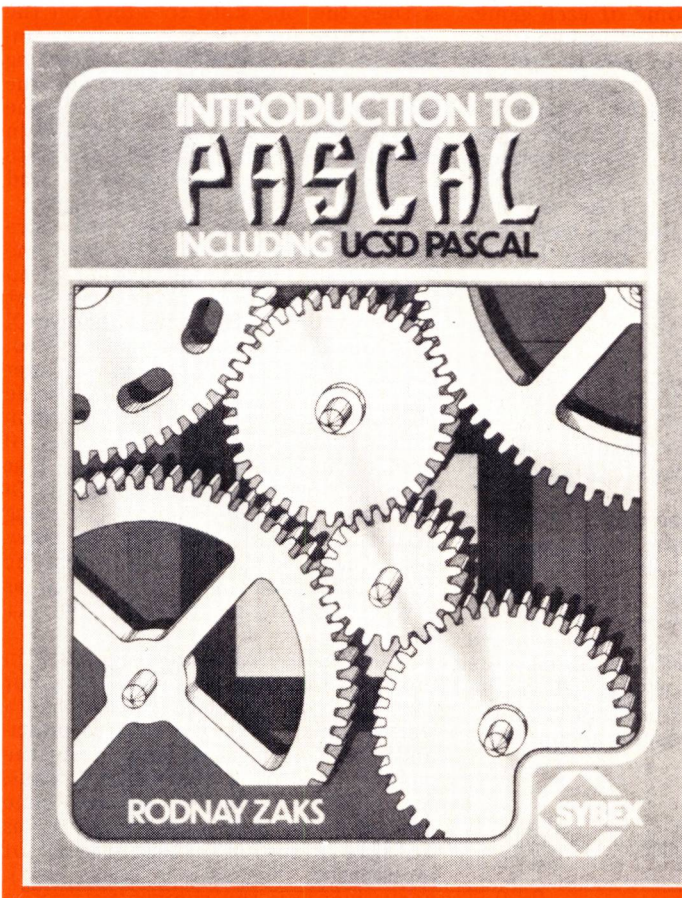
Each time a game is played, the weights for the moves taken are adjusted. If the computer won, the weights are increased, improving its chances of following the same path again. If it loses, they are decreased. The amount of change is open to fine-tuning. The weights for moves near the end of the game should be altered more than those near the start. A move at the end which leads immediately to a win can be weighted 100 per cent and the other moves from that state ignored in future. The program will then learn quickly how to do well at the end of the game. A move near the beginning which

**SYBEX**

unlocks PASCALS

**INTRODUCTION TO PASCAL**including UCSD Pascal
by Rodnay Zaks400pp 100 illustrations **£9.10****THE PASCAL HANDBOOK**

by Jacques Tiberghien

300pp 150 illustrations **£10.05**

Finally Pascal is accessible to everyone. This simple, yet complete guide to standard and UCSD Pascal contains step-by-step instructions for learning the powerful Pascal language, as well as exercises designed to develop skill and comprehension throughout the learning process.

Beginners will be able to understand the entire book and quickly learn to program in Pascal through actual practice. Experienced programmers will be challenged by the complex concepts presented at the end of each chapter. Everyone will appreciate the organization and extensive appendices which make this book a valuable reference tool.

Here is a complete new approach to Pascal. Every Pascal Symbol, reserved word, identifier and operation is described in alphabetical order. Each entry includes definition, syntactic diagram and semantic description, implementation, variations and program examples. This comprehensive dictionary contains all the features of most existing versions of Pascal in an easy-to-use, easy-to-read format (see example, opposite page). Pascal Versions you will find in the PASCAL HANDBOOK include Jensen and Wirth (Standard and CDC version), H-P1000, OMSI, (DEC), PASCAL/Z ISO AND UCSD Pascal.

Dept. PCW

**The Computer
Bookshop**

Temple House, 43/48 New Street, Birmingham B2 4LA

Get these invaluable books from your Local Bookshop or Micro Store — NOW! In case of difficulty, send S.A.E. and we'll let you have the name of your nearest stockist.


```

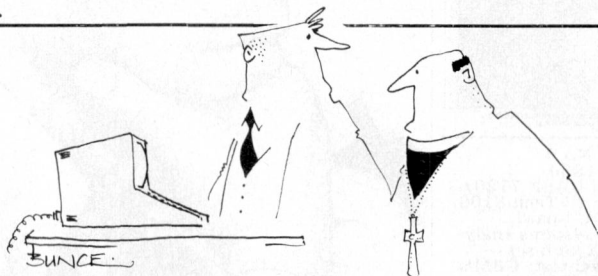
100 INIT
110 DIM M(17,17)
120 DIM C(17)
130 DATA 0,1,1,1,1,1,1,0,1,0,0,0,0,0,0,0,0
140 DATA 0,0,0,1,1,1,0,1,1,1,1,0,0,0,0,0,0
150 DATA 0,0,0,0,1,1,1,0,1,0,1,1,0,0,0,0,0
160 DATA 0,0,0,0,0,0,0,1,0,0,1,0,0,0,0,0,0
170 DATA 0,0,0,0,0,0,0,1,1,0,1,1,1,0,0,0,0
180 DATA 0,0,0,0,0,0,0,1,1,1,1,1,1,0,0,0,0
190 DATA 0,0,0,0,0,0,0,0,1,0,1,0,0,1,0,0,0
200 DATA 0,0,0,0,0,0,0,0,0,0,1,0,1,0,0,0,0
210 DATA 0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,0,0
220 DATA 0,0,0,0,0,0,0,0,0,0,0,1,1,1,0,1,0
230 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,1,0
240 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,1,0
250 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1
260 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1
270 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1
280 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1
290 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
300 READ M
310 FOR I=1 TO 17
320 C(I)=0
330 NEXT I
340 C(1)=1
350 FOR I=1 TO 16
360 FOR J=1 TO 17
370 IF M(I,J)=0 THEN 390
380 C(J)=C(J)+C(I)
390 NEXT J
400 NEXT I
410 PRINT C(17)
420 END

```

Program A

is on a winning route may also be on several losing ones. It should not be ruled out too quickly as the program cannot learn fully what to do at one stage of the game until it knows more about what happens later. In this way the learning process and the backwards search for Safe positions are very similar.

It is not necessary to have an electronic computer to construct such a learning machine. I visited Ulster Polytechnic in Belfast recently and John Frazer, head of Art and Design Research, told me how they had built a machine that learnt to play noughts and crosses using art students and match boxes. There is one box for each state in the state diagram. It is marked with the moves that can be made from it. These are colour-coded on each box and in the box are coloured counters the numbers of which determine the weightings for the moves. Initially each box contains an equal number of counters of each of its colours.



'Certainly sir — you can program it to believe in absolutely anything!'

```

100 INIT
110 DIM M(17,17),S(17)
120 DIM T(17)
130 DATA 0,1,1,1,1,1,1,0,1,0,0,0,0,0,0,0,0
— — — — — — — — — — — — — — — — —
290 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
300 READ M
500 FOR I=1 TO 17
510 S(I)=0
520 NEXT I
530 A=0
540 FOR I=1 TO 17
550 IF S(I)<>0 THEN 630
560 FOR J=1 TO 17
570 IF S(J)<>0 THEN 590
580 IF M(I,J)>0 THEN 630
590 NEXT J
600 A=A+1
610 S(I)=1
620 T(A)=I
630 NEXT I
640 IF A=0 THEN 730
650 FOR X=1 TO A
660 J=T(X)
670 FOR I=1 TO 17
680 IF M(I,J)=0 THEN 700
690 S(I)=-1
700 NEXT I
710 NEXT X
720 GO TO 530
730 FOR I=1 TO 17
740 IF S(I)<0 THEN 770
750 PRINT "SAFE ";I
760 GO TO 730
770 PRINT "UNSAFE ";I
780 NEXT I
790 END

```

```

UNSAFE 1
UNSAFE 2
UNSAFE 3
SAFE 4
UNSAFE 5
UNSAFE 6
SAFE 7
UNSAFE 8
UNSAFE 9
UNSAFE 10
UNSAFE 11
UNSAFE 12
SAFE 13
UNSAFE 14
UNSAFE 15
UNSAFE 16
SAFE 17

```

Program B

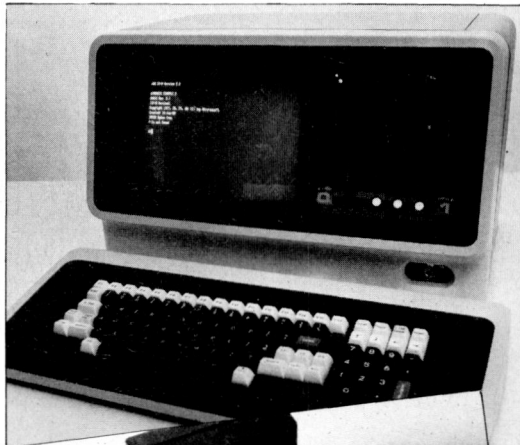
ning process will be diluted. Passing through one instance of a state, the program will not benefit from what it learnt from using the other instance of it. The program will behave as though it has a split memory.

Next month

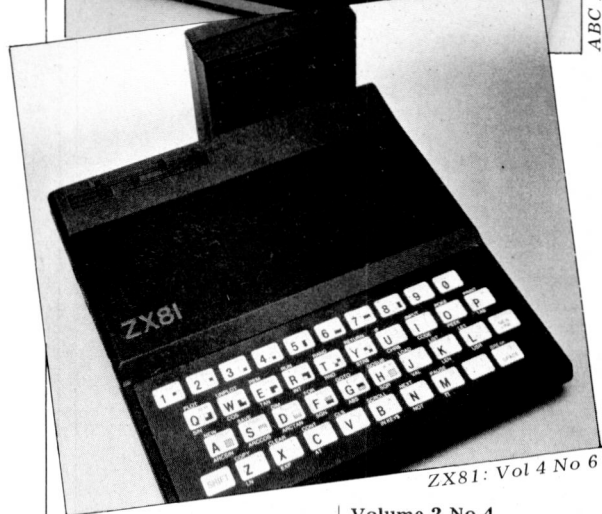
Next month I will describe some ways of generating pseudo-random values with little computation and without using the RND function.

BACK ISSUES SERVICE

Here is a complete guide to all available back issues of *PCW*. A quick guide to their contents is shown below. Check the coupon overleaf for the issues you require.



ABC 24: Vol 4 No 4



ZX81: Vol 4 No 6

Volume 1 No 1, 1978
The 77-68/Practical hints on kit building/Nascom 1/Charity case study/Flowcharting/Pontoon flowchart

Volume 1 No 2, 1978
Kit building/Basic — first steps/Case study — a software house/PET 2001/Research machines 380Z/School computing/E78 — Europa Bus.

Volume 1 No 3, 1978
More efficient programs/Cosmac 1802/The PDP11 Part 1/Small business computing — an approach/The Z80/EPROM programmer construction.

Volume 1 No 4 August 1978
From ideas to programs/A computer or a kit?/The KIM/Tandy TRS-80 Apple II

Volume 1 No 5 September 1978
School computing/Bits and Bytes for beginners/The PDP II Part II/The S100 bus

Volume 1 No 6 October 1978
Pilot/Assembly code programming/Small business case study/PET preening/Time tabling for schools.

Volume 1 No 8 December 1978
Microcomputer architecture/System design/Colossus/Medical interviewing machine/Hints for the business beginner/Cromemco Z2D/School computing/3rd Noughts & crosses/Low cost/High speed cassette interface

Volume 2 No 4 September 1979
Apple medical application/North Star Horizon/Word processing/High speed cassette interface/Sorting/Buying a computer for a small business

Volume 2 No 5 September 1979
Benchtest: Compucolor II/Checkout: Heuristics Speech Lab/Testing Recognition/Pascal series — Part 1/Programs: 6800 Time response, Apple memory test, Fx 201p spaceship, PET Orbit sim, PET digital clock, Acronyms.

Volume 1 No 11 March 1979
SYM-1/Mk14/IEEE-488 Bus/Motorola 6809/Small computer networks/TMS-9900 homebrew.

Volume 1 No 12 April 1979
Kim 3B — Additions/Vector MZ/RM 380Z User interviewer/Computer aided learning.

Volume 2 No 1 May 1979
Chess programming/Using a small business computer Part 1/Smart 1/In defence of PET/3D Noughts & crosses.

Volume 2 No 2 June 1979
Different computer languages/MSI 6800/Using a small business computer Part II/Demonstrations using the Apple II Part I.

Volume 2 No 3 July 1979
Basic or Pascal?/The Sorcerer/Z8000/Chess programming/Graphs for the TRS-80/Apple vision — part II/



Volume 3 No 5 May 1980
Benchtest: Texas TI 99/4 / Benchtest: ACS 8000-2/ Benchmark round-up/ Benchtest: HP85/Viewdata — Part 2/Checkout: Microdata UV8 EPROM Eraser/ DIY teleprinter conversion feature/Nascom music/ T159 accountancy application.



Volume 3 No 6 June 1980
Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Perflex 630/48 / Staff case study/Checkout: Softy Intelligent EPROM Programmer/Checkout: Exatron Stringy Floppy/ Practical examples of the IEEE-488 bus use/ Programs: Naming Nascom files, 380Z Pictures, Fuel tank calculations — PET, PET large numeral generator, PET tank battle, Basic string handling routines/Pascal: Final instalment.



Volume 3 No 9 September 1980
Benchtest: BASF 7120/ Checkout: Hi-Tech S100 colour VDU board/ Secrets of systems analysis — Part 1/Sub set — part 1/Benchtest: CBM's 'SuperPET'/Programs: PET Dots & boxes, PET Bloopers, PET Demolition,

Apple Showpiece, PEEK & POKE for Apple & Pascal, PET Giant Slalom, Speed & Acceleration.



Volume 3 No 10 October 1980
3-D graphics/Benchtest: Atari 400 & 800/Benchtest: DAI/Robotics/ Benchmarks/Programs: PET Racer, PET Fighter Pilot, UK101 Graphics, Apple Plotting, UK101 Gunfight, PET Algebraic evaluation, ZX80 Breakout

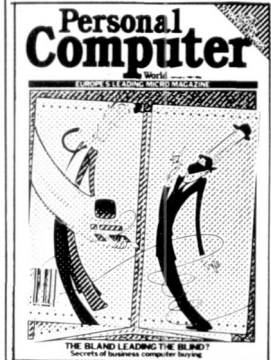


Volume 3 No 11 November 1980
Benchtest: the SBS-8000/ Announcing Computertown UK!/Apple/ITT 2020 Colour graphics/Imp printer/Programs: PET Ski,

MZ-80K Bouncing ball, Superboard-UK101 Bug bypass, PET Replace



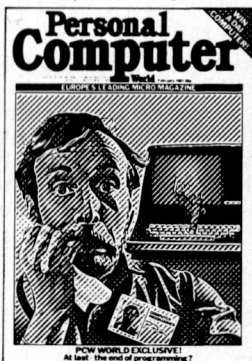
Volume 3 No 12 December 1980
Benchtest: Microwriter/ Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon



Volume 4 No 1 January 1981
Benchtest: Transam Tuscan/Real-time control using trains — part 1/ Recover from a data tape disaster/PET Music/



Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram



Volume 4 No 2
February 1981
Benchtest: The Vector Graphics VIP/Patterns — Part 1/The last one/Real time control — part 2/Multi-user systems part 2/ZX80 Printer/Programs:

PET Greenfingers, ZX80 Bumber Bundle (3 programs), PET Brick Stop



Volume 4 No 3
March 1981
Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 34C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.

Personal Computer



Volume 4 No 4
April 1981
Benchtest: ABC 24/Slow scan TV/IDPM/Word processing: Benchtests/ZX80 books/Commons report/Casio fx 3500p/Programs: ZX80 Maths Test, ZX80 Calendar, PET Link Index, ZX80 Moon Lander, TRS80 Rocket Attack, TRS80 Dropout, PET Giant Trap.

Personal Computer



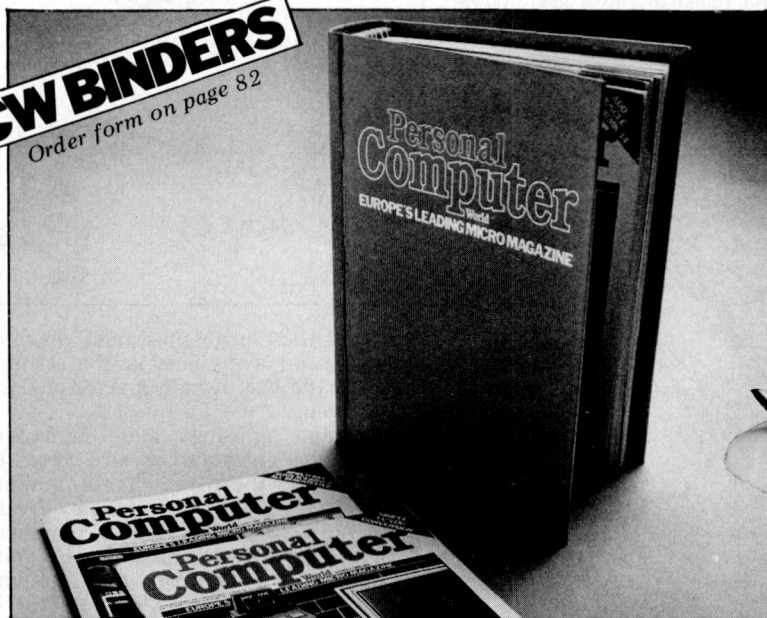
Volume 4 No 5
May 1981
Benchtest: Pasca 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

Personal Computer



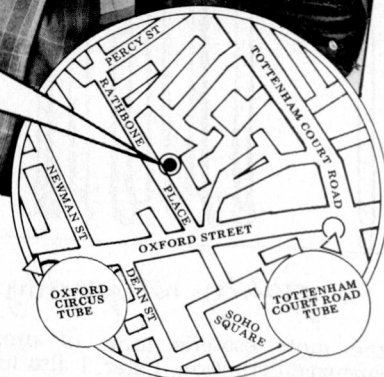
Volume 4 No 6
June 1981
Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 Plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

PCW BINDERS
Order form on page 82



BACK ISSUES CENTRE COME UP AND SEE US...

We have a complete selection of all available PCW back numbers in our flashy new Back Issues Centre in the West End, just half a minute's walk from Oxford Street (close to Tottenham Court Road tube station). Of course, you could order them from our excellent mail order service by using the coupon below, but this way there's no postage to pay and you get the benefit of a free friendly bag and a plastic smile from our lovely receptionists, Sara and Maggie (surely some mistake here? Ed.) We can also take your subscription or sell you a set of binders. Drop by next time you're in the West End, 14 Rathbone Place, London W1.



Any one issue £1.25; Any two issues £2.25; Any three issues £3.00; Any four issues £3.75. All additional issues @ 75p each. Binders @ £3.25. All prices include post and packing. Cheque or P.O. payable to (PCW) Sportscene Publishers Ltd., 14 Rathbone Place, London W1P 1DE. Please allow up

to 3 weeks for delivery and don't forget to state clearly your name and full address with your order. Please send me the following copies of PCW. I enclose a cheque/P.O. for £_____. Please tick appropriate boxes.

Volume 1	Volume 2	Volume 3	Volume 4
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐	5 ☐ 6 ☐	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐
8 ☐ 11 ☐ 12 ☐		9 ☐ 10 ☐ 11 ☐ 12 ☐	

Name _____ Address _____

Once again Malcolm Peltu mounts his structured programming hobby-horse
— then looks at the ZX81 manual.

More quality, less Basic

Regular readers of 'Bookfare' might think I have been conducting an anti-Basic, pro-Cobol campaign. Through my own words and those of some books reviewed, I have indeed strongly stated the arguments against regarding Basic as a universal programming panacea.

But as reader Frank Little pointed out in the March PCW, the real argument is not primarily about Basic versus Cobol. What I have been trying to highlight is the importance of injecting notions of *quality* into programming objectives and implementations. My main objection to Basic is that it has done little to improve or promote concepts of programming quality, although it has helped to increase the quantity of programming being done.

I also object to the trendy notion that, just because it is easy to write a program in Basic, programming and the whole theoretical and practical foundations of systems and information sciences are also simple.

This month I would therefore like to turn the spotlight on three books which, in very different ways, examine the qualitative aspects of programming, starting with a neat little book from the National Computing Centre, *On-line programming — A Management Guide* by Joe Abbott. The other two books are concerned with structured design and

involved in computing.

I can remember some golden batch programming days when you were content with getting one run a day — and then you were likely to find the operators had shuffled your punched cards to produce a syntax error or there had been an obvious slip of the programming mind. This kind of environment created huge delays while programs were punched by the programmer or data preparation staff, delivered to the computer and the results posted back.

Plugging the programmer directly to the computer via an on-line link had obvious advantages in cutting through these delays. But, as Abbott points out, 'the introduction of on-line programming has little direct impact on the quality of programs and programming because these are governed mainly by the languages, design

You Can't teach an old C.P....



strategies and quality-control techniques used, none of which need change simply because on-line programming is introduced.'

But he says that on-line programming can have an indirect impact on programming quality, 'ranging from a substantial improvement to a substantial degradation.' The main improvements can come if the time saved in program development is at least partly used in adding to the time and resources spent on better quality control techniques, including better structured design, improved documentation, audit checks, etc. There is a danger, however, that any time saved in program development will be used as an excuse to try to rush through more programs. Never mind the quality, feel the bug-ridden width.

On-line programming, says Abbott, also creates an internal pressure on the programmer to write more lines of code. This contributes to the 'hasty and impulsive style of programming which unfortunately often characterises on-line programming.' Abbott's perception of the importance of subjective programmer attitudes in determining the effectiveness of program development is the main strength of the book.

Too often, books on this subject ignore the human element.

When he was talking to Data Processing managers in researching the book, Abbott found that they were frequently at a loss to explain just why they were experiencing on-line programming problems. Abbott began to realise that

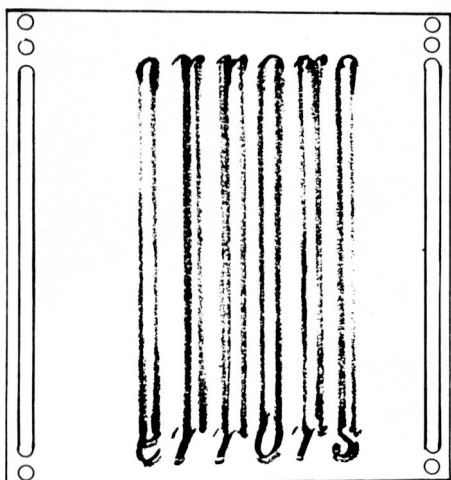


many of these problems boiled down to an increased sloppiness in the attitude of staff and the overall operation of the department.

In an amusing and important chapter, he characterises five types of programmer: speed merchants, tedium-haters, perfectionists, technology freaks and old dogs. 'A speed merchant believes that the purpose of program testing is to find errors and that any purposeful searching for errors in advance of program testing is an unnecessary and wasteful duplication of effort,' explains Abbott. On-line programming encourages the speed merchant by enabling programs to be written in an even more quick-fire manner than before and makes him or her even more careless in the belief that errors can be eliminated simply by having more test runs.

Abbott describes the tedium-haters as programmers who hate the routine side of programming. 'Program documentation, testing and any form of record keeping are seen as evils, grudgingly admitted to be necessary. Whilst such programmers hate planning, the creation of test-files and the repetitive checking of results, they love the challenge of "insoluble" program errors.' In a traditional batch environment, the tedium-hater is forced to fill in some time by doing more testing than he or she feels desirable. In on-line development, however, the tedium-hater justifies the lack of testing and documentation by arguing that on-line systems have been introduced in order to improve the speed and volume of work.

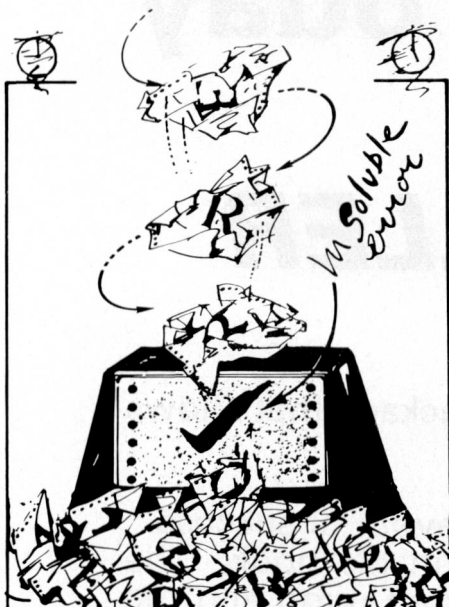
The perfectionist 'knows that the testing process has no perfect ending' and so continues to search for it. The



quality not quantity

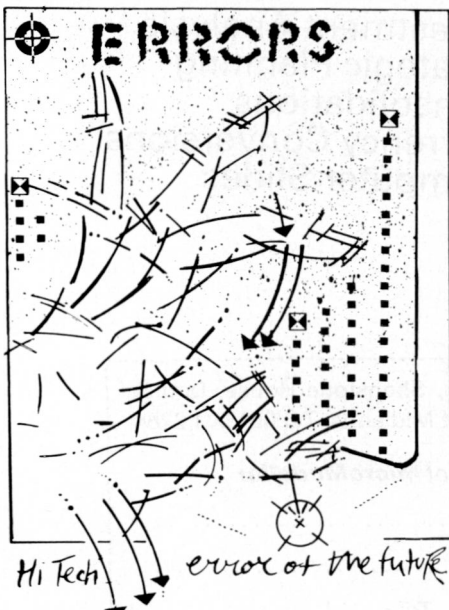
the more esoteric topic of program language definition. Later, I also have a few critical comments on the ZX81 manual.

To most personal computer users, on-line interactive programming is a natural way of life. Yet for many commercial programmers, batch programming is still the order of the day. There was a time not long ago when on-line programming was virtually unheard of. Abbott's book is aimed primarily at managers in organisations with large DP departments but much of what he says provides a valuable insight into the programming psyche which should be of interest and enlightenment to anyone



perfectionist is obsessed not only with accuracy but also with style in code and documentation. 'Whilst their aims may be laudable, perfectionists can be a real pain in the neck because they go to extremes and expect everyone else to do likewise.' Perfectionists regard the availability of more computing resources via on-line links as a cue to take even more time in searching for computing Nirvana.

Technology freaks make as much use as possible of hardware and software as a matter of principle. 'They become fanatical about split-screen editing, copying and duplication of code and interactive testing. When challenged about their disproportionate use of resources, they claim they have learned to use the technology where other programmers have not,' comments



Abbott. Once again, on-line programming increases the sloppiness of this programming bird by placing more resources at its twitching fingertips.

Abbott came across one programmer who declared himself an old dog who

would learn no new on-line tricks. 'His loyalty and devotion to his masters earned him a reprieve and he was left alone in the hope that he would eventually grow out of it,' says Abbott.

Abbott goes on to discuss some practical guidelines for effecting on-line programming. But I have concentrated on his witty descriptions of programmer types as they are of general applicability and set the human scene for the next two books under review. These deal with complex and evolving technical debates which attempt to keep the speed freak, the old dog, the hobbyist, the technology freak and other programmers under control.

Designs on your programs

Basic and personal computers opened up the world of computing to a wide-eyed new audience by making the complexities of computing seem simple. Basic, however, was built with ease of use in mind rather than for implementing principles of good program design.

It has taken a long time for the computer science purists to come to terms with personal computing; for a long time they dismissed it as an irrelevant toy. But now that microcomputers are increasingly encroaching on business, industrial and scientific data processing, there is a growing need to popularise what had previously been viewed as the preserve of specialist computer scientists and data processing professionals.

Using Structured Design by Wayne P Stevens is a step in the right direction because it tries to explain structured design principles and practice to both the uninitiated and to DP professionals. *The Definition of Programming Languages* by Andrew D McGettrick is aimed mainly at advanced computer science students but it indicates that even an apparently abstruse subject can be expressed in down-to-earth terms, even if, in this case, the understandable bits are wrapped in a great deal of mathematical notation.

The subtitle of Stevens' book succinctly summarises the aim of structured design: how to make programs simple, changeable, flexible and re-usable. Stevens was one of an IBM team which formulated a structured design strategy which has had great influence in commercial DP.

'Structured design reduces the cost of developing and maintaining programs by reducing the time and effort required. It does so by reducing complexity and by making it easier to implement changes — both to fix an error and to add a new requirement,' Stevens explains in the introduction. And he proceeds to describe how this is done with a clarity that enables the principles he expounds to be easily extracted from the specific examples he uses, which are in Cobol and oriented to large DP systems.

These principles of simplicity and modularity of design, with priority

given to the ease with which the program can be understood, modified and enhanced, are applicable to virtually every program. Within this structured strategy, the foibles of individual programmers become less significant because faults can be isolated within particular modules and programmers are given clear objectives on which they can be monitored.

Structured design means putting greater effort into the phase between specifying system objectives and coding. This fits in with Joe Abbott's assertion that on-line programming can improve program quality if time and resources saved by using on-line techniques are specifically allocated to giving priority to structured design and other methods which improve overall quality. As Stevens aims to provide a practical introduction to the subject, he necessarily gets involved in describing the mechanics of his particular approach to structured design. This should not put off any seeker of the essential truths of program design.

The book is full of nuggets of good advice, such as: 'Solutions can often be made dramatically simpler just by concentrating on finding the simplest alternative. It is unfortunate how much unnecessary complexity results from designs based on premature attention to performance considerations or to presumed future needs. It is easier to achieve the best performance by designing the simplest solution first.'

He warns, however, that simplicity should not be thought of as equivalent to writing the fewest lines of code. 'The fewest lines of code can probably be arrived at only through a process of optimisation. This is by definition not the simplest way to write the code and usually results in code that is hard to change.'

In *Using Structured Design*, Stevens has distilled a wealth of experience into a form which could inject some much-needed good sense into everyone's code. (Incidentally, he does not even mention Basic.)

Andrew McGettrick's book tackles a subject which is more removed from daily programming needs, the definition of programming languages. This is an important practical subject, however, because the clarity and comprehensiveness with which a language is defined influences the ease with which standards for the language can be established, compilers and interpreters developed and the quality of programs produced. It is also a subject which delves into linguistics, logic and mathematical theory, which does not lend itself to light bed-time reading. As McGettrick has written the book primarily for inclusion in computer science courses, he naturally goes into considerable depth into this theory.

But for the average, non-specialist reader, it is possible to pick one's way through the technicalities to find out some fascinating historical background to the way different languages have developed and the attempts made to rationalise language definitions.

See the Future Today with **MICROMODELLER**

MicroModeller is the widely acclaimed software package that allows even the smallest businesses to plan for the future.

Why plan? "Planning is about altering the odds in favour of success", says Robert Heller, Editor of *Management Today* in his book, 'The Business of Winning'. "Fortune favours the prepared mind and the prepared company - better decisions flow continuously from better preparation."

MicroModeller has been widely acclaimed because it dramatically reduces the cost of using a computer for financial planning, preparation of budgets, production of management reports, and multi-level consolidations, by taking full advantage of the latest micro computer technology. *The **MicroModeller** program, together with the Apple II personal computer is a complete alternative to costly time-sharing services.* Far more flexible than in-house data processing services, **MicroModeller** puts the manager in full control for the first time.

MicroModeller is used by management for a wide variety of applications, including:

- * Cash Flow Forecasting
- * Budgeting
- * Short-Term Planning
- * Merger & Acquisition Analysis
- * Computer Graphics
- * Investment Analysis
- * Strategic Planning
- * Consolidations
- * Currency Conversions
- * Computer Slides

Yet the **MicroModeller** Financial Planning program for the Apple II costs just £425 plus VAT.

A complete system including Apple II, black & white monitor and printer starts at around £3000.

ACT



To **ACT Microsoft Ltd.**, Shenstone House, Dudley Road, Halesowen, West Midlands. Tel. 021 501 2284

Please rush me details of **MicroModeller**

Name.....

Address.....

..... Tel.

I do/do not already own an Apple II.
I do/do not have experience of financial modelling.

The Fortran language, for example, grew very much from the machine upwards. The Fortran project started in 1954 with the aim of providing a high level language for the IBM 704 computer and many of the features of Fortran are related to the structure of the machine. At a later stage, the American Standards Association (ASA) became involved in trying to standardise Fortran. Since then, the ASA, under its new name of the American National Standards Institute (ANSI), has played a leading role in international standardisation.

Another stream of computer languages grew out of a working group of the International Federation of Information Processing (IFIP) in 1960 and eventually became known as Algol 60. This working party developed an elegant means of defining Algol and took a more idealistic, theoretical approach to language design than Fortran, Cobol and Basic, which had a more pragmatic approach. The structured approach to defining Algol was reflected in the language, which promotes a block-structured approach to programming that is an important step on the way to good structured design. Pascal, among other languages, grew from this Algol seed, which is why Pascal fulfills more principles of good systems and programming theory than the pragmatic approach of Basic.

McGettrick provides sufficient evidence that he can write for a lay audience; he should try to tackle the formidable task of writing a book on this subject which avoids the technicalities and concentrates on the historical, philosophical, theoretical and practical forces which have interwoven to create the modern computing language scene.

Taken together, Abbott, Stevens and McGettrick cover a great deal of important ground which should eventually become as much a part of the personal computing consciousness as Basic and all the other paraphernalia that currently fills PCW.

Joe Bloggs on the ZX81 manual

While on the subject of reinterpreting complexities for a mass market, I would like to poke my oar in on the ZX81 manual. The ZX81's admirable technological capability and the value for money have already been evaluated by David Tebbutt in the May PCW. For a computing freak who cannot afford anything more expensive, many hours of fun can be obtained from the ZX81, particularly if you have the 16k RAM. My concern, however, is the way the ZX81 manual fails to appeal to Joe and Gladys Bloggs. Sinclair's advertising in the non-technical press makes it clear that the company is interested in selling to Joe and Gladys, the ordinary people still mystified by computing.

So what happens when the Bloggs unwrap their new ZX81? They will probably find it easy enough to plug in

to the TV but they may be caused a little problem in searching for a shop that supplies a jack-to-DIN plug if they have a DIN-socket tape recorder.

But then what? They are faced with a closely-typed, 200-page manual. It starts by telling them how to get the feel of the keyboard with a very simple program. And here comes the first shock: the keyboard is cramped, crowded and complex-looking. Chapter 3 of the manual gives a half-page history which the Bloggs will probably find virtually useless. It merely states that the ZX81 uses Basic but there are other languages with 'a neater structure and greater power' or ones that can also be used 'on-line'. The words I have put in quotes should be explained to the Bloggs or else not used at all.

Then comes Chapter 4 — the ZX81 as a calculator. Great stuff if you are doing maths at school or university and feel at home with operands, unary minus and mantissa. But pity the poor Bloggs. Within this chapter, the use of commas and semicolons in the PRINT command are described. The Bloggs will want to know this but will probably miss it out here because all their worst fears about the computer being something mysterious and 'mathematical' may have been confirmed.

Chapter 5 is concerned with mathematical functions and it is only in Chapter 6 that ordinary words are used in examples, like a variable called EGGS. Yet here again, the manual quickly says 'should you want to know the square of the sine of the price of one egg type: PRINT SIN (EGGS/12)**2'. Besides confusing the Bloggs by talking about squares of sines, if they do type this on the machine, they will be greeted with an error message.

The book is structured in such a way that it is difficult to find elementary facilities, like the spacings in PRINT, without delving into chapters with titles that would be meaningless to the

Bloggs. And the index is totally inadequate. I also found at least one instance of a misprint in an example (the second example on page 83) and a number of occasions where the machine did not do what was intended, as in the square sines of eggs illustration.

But the chapter on what happens when the computer gets full will probably frighten the Bloggs most. 'When the memory fills up odd things can happen; but they are not usually fatal,' says the manual. To the Bloggs, who thought they were buying a clever machine that will play Space Invaders as well as teach little Sid about programming, unpredictability such as this can be frightening, particularly when words like 'fatal' are used.

Sinclair should have done better. In fact, it did with the ZX80 manual, which was much more readable and explained examples more clearly. Perhaps it should employ Tim Hartnell to write the next one. His *Making the Most of Your ZX80* (reviewed in April PCW) shows that it is possible to appeal to the Bloggs by showing how to write simple games programs and, at the same time, explaining Basic principles.

It would also be nice if introductory material to systems like the ZX81 tried to explain the concepts of information management and systems design; as well as how to write a Basic program. I look forward to the Ladybird book on structured programming.

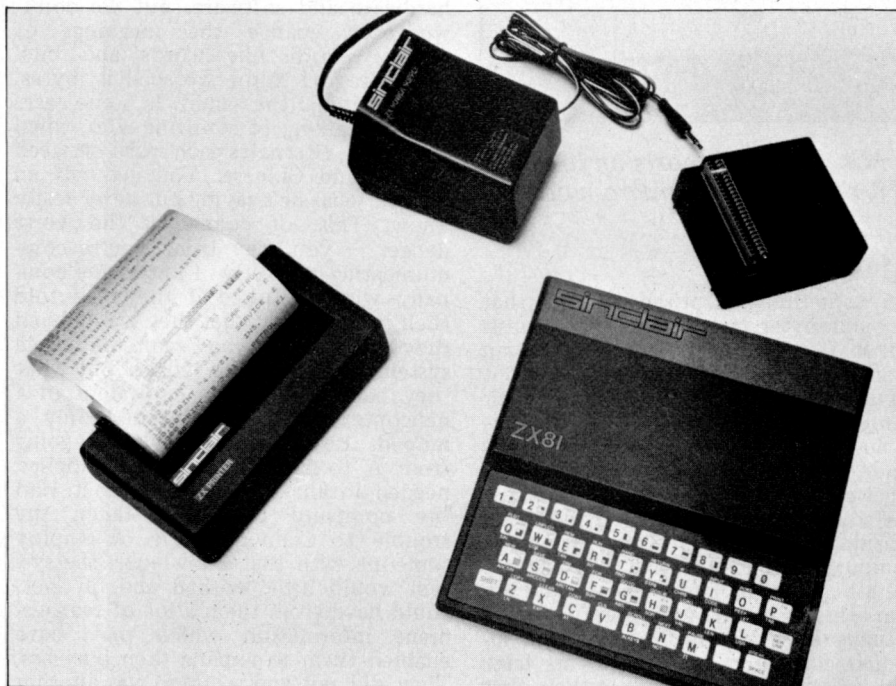
In this month's 'Bookare' were:

On-line Programming: A Management Guide by Joe Abbott (National Computing Centre, £7.50);

Using Structured Design by Wayne P Stevens (John Wiley & Sons, £14.20);

The Definition of Programming Languages by Andrew D McGettrick (Cambridge University Press, £6.25 paperback, £13.50 hardback);

The ZX81 Basic Programming Manual (free with the Sinclair ZX81).



UP THE SHARP END



Mike Knight reports on life as it really is in the micro world.

I'm sometimes surprised to find that any computer installations are successful. In fact, if some business people ran their companies the way they set about buying computers, I'm surprised their companies still exist.

In some cases, the decision to buy is made simply as a result of a chance meeting on the golf course. You know the situation: MD comes in on Monday morning, saying, 'Old Bloggs has got a computer. Find out what it is and get me a bigger one.' I wish that I could say that this was an exaggeration but I actually know four companies who installed computers and two years later had either not implemented their first

system or even started the programming for their first system. In one case, the final decision to choose between two separate 'hardware' systems was made simply on the colour of one of them, even though the other system was obviously more technically suitable for that company. It's almost as if large numbers of normally sane businessmen and women are human lemmings rushing to mass computer suicide. What causes this orgy of self-destruction?

Well, I believe there are three main problem areas: computer mystique, non-communicating computer people, and good old-fashioned lack of planning.

If we loom at the first of these areas, computer mystique, the surprising thing is that it causes the most trouble to people who are usually vehement supporters of computers. The sort of person I mean is probably an avid watcher of programmes such as *Tomorrow's World*. His or her children are probably doing computer studies at school or college. They are also most likely to support the exhortations of politicians and others to 'join the communications revolution'. It's no surprise, therefore, that the computer starts off as some sort of deity. Now I don't think I will be able to change the sensationalism of computers in the media but the solution to mystique is knowledge. Is there a ComputerTown in your area? If there is, join it. If there isn't, how about starting one? (I know my Editor will love this but seriously, folks, why don't you start one?) If you are not the organising type, then why not buy a small personal computer or even a programmable calculator? Mystery clears when you've written a few programs, or had to reload a cassette program a number of times because of mis-reads.

Now you may have noticed that I've said nothing about talking to anyone you may know in the computer industry. The reason is simple: in many cases, such a talk would just confirm the computer mystique. In fact, for people involved in communications, computer industry employees are incomprehensible. It wouldn't be so bad if we stuck to our jargon like input and output and hardware and software, but we don't; we even change the meanings of ordinary words like 'words' and 'bits' and 'bites' (I know we spell it 'bytes' but it sounds the same). In some cases it's like talking to someone who, when he speaks, alternates each word between English and Chinese. You get half an idea of what he's saying but never really know. This, of course, is the worst danger — you may think you're communicating perfectly. I know one company where I asked if they had told their programmer what they wanted and they said yes. They had wanted a simple system for their sales ledger. But what they had got was the equivalent of a helicopter when they needed only a moped. Both were capable of going from A to B but the system supplied needed a trained pilot to operate it. Had the company concerned taken the trouble to train someone or employ someone with that knowledge, the system would have worked and, in fact, could have given them a lot of management information which may have enabled them to expand their business. They did not and so there was another

computer 'failure'. But I wonder how much of the blame attaches to the programmer who was unable to tell them what he was providing?

A worse illustration of the non-communicating computer person is the following: a company I know did everything right. It started by employing a consultant who investigated the feasibility of what the company wanted to do, and finally produced a report which detailed requirements exactly on paper. This was given to the software house it employed and then programs were written to meet that specification. Two years later the system was still not implemented because, in the words of the senior partner, 'we just could not communicate with the programmer. The programs had "bugs" and he wasn't able to explain what his problems were.' Now the partner concerned has his own personal computer so was well able to understand programming problems but, even so, the computer man couldn't get through. The story has at least got a happy ending, since the company concerned has now contacted other programmers and it looks as though it will eventually get its system working.

What is so worrying about this last case is that the management involved did everything right. They started by defining what they wanted to do. They then hired a consultant to investigate whether the system could be handled by microcomputers. The consultant produced a full system specification and the company used this to get quotations from a number of local software houses. Now at this stage, had any of the software houses concerned had a 'package' which met the specification, there would now be a successful installation which would have been running for about a year. Unfortunately, the requirements were mainly in the stock control area and at that stage no packages were available which met these needs. In fact, even now they would probably still have to have a custom-built system. The problem therefore still exists. How, having defined your requirements, do you get the software house to show its ability (or lack of ability) to communicate? I would suggest that you get them to produce written program specifications and proposed operating instructions first. Now you may have to pay for this separately, particularly if you are then not going to let them do the programming, but at least you know if they can or cannot communicate. As a last resort these program specifications might enable you to do it yourself. It's more likely, however, that you could use them as the basis for writing your own program specifications in your own language. These could be used by other software houses and you would have the advantage of knowing what the programs were going to do before you got them.

Finally, I don't want to paint too gloomy a picture of computer people. Most of us try hard not to speak in a 'foreign' language, but if you don't understand us please say so straight away and we'll try and express ourselves in another way. In the end you'll get what you want — a successful computer system. But remember: when you are looking for a computer system the last thing you want is the computer.

**Comart Approved
Dealers**

Belfast

O & M Systems
95 Dublin Road
Tel: 0232 49440

Birmingham

Byteshop Computerland Ltd
94/96 Hurst St, B5 4TD
Tel: 021 622 7149

Cambridge

Cambridge Computer Stores
1 Emmanuel St, CB1 1NE
Tel: 0223 68155

Cornwall

Benchmark Computer
Systems Ltd
Tremena Manor
Tremena Road
St Austell, PL25 5GG
Tel: 0726 610000

Dublin

Lendac Data Systems Ltd
8 Dawson St
Tel: 0001 372052

Glasgow

Byteshop Computerland Ltd
Magnet House
61 Waterloo St, G2 7BP
Tel: 041 221 7409

Leeds

Holdene Ltd
Manchester Unity House
11/12 Rampart Road
Woodhouse St
Tel: 0532 459459

London

Byteshop Computerland Ltd
324 Euston Road
London W1
Tel: 01-387 0505

Digitus

9 Macklin Street
Covent Garden WC2
Tel: 01 405 6761

Jarrogate

67 Tulsemere Road,
West Norwood,
London SE17
Tel: 01-670 3674

Manchester

Byteshop Computerland Ltd
11 Gateway House
Piccadilly Station Approach
Tel: 061 236 4737

NSC Computers

29 Hanging Ditch
Tel: 061 832 2269

Newbury

Newbear Computing Store
40 Bartholomew St
Tel: 0635 30505

Nottingham

Byteshop Computerland Ltd
92A Upper Parliament St,
NG1 6LF
Tel: 0602 40576

Sheffield

Hallam Computer Systems
451 Eccleshall Road, S11 9PN
Tel: 0742 663125

Southampton

Xitan Systems
23 Cumberland Place,
SO1 2BB
Tel: 0703 38740

Sudbury

Eurotec Consultants
Holbrook Hall
Little Waldingford
Tel: 0206 262319

Warwick

Business & Leisure
Microcomputers
16 The Square
Kenilworth
Tel: 0926 512127

Watford

Lux Computer Services
108 The Parade
High Street
Watford WD11 2AW
Tel: 0923 29513

Comart Microcomputer dealers
are located strategically
throughout the country to give
support, guidance and
assistance. In the event of
difficulty contact Comart direct.

comart communicator

The clean simplicity outside...



...conceals the pedigree inside.

Comart's CP100 Communicator is the new British designed, British made Microcomputer from Comart. It is the result of a carefully conceived development programme. It exploits Comart's first hand experience of the British computer market, and their growing strength as a manufacturer.

CP100 is the first of a new generation of flexible, expandable micros specifically developed to suit British operating conditions and communication requirements.

The clean lines outside, conceal the power within; its S-100 bus means wide ranging peripheral support, and simple after sales care. And, that's not all. Communicator is built to keep your future options open. It's ready for Prestel, asynchronous, and synchronous operation. It has expandable memory capability and yet it's price competitive as a stand-alone system with its CP/M™ operating system, and support software.

Find out more about Communicator today.

The U.K. Leaders in Microcomputer
Development, Application and Support.

comart

St Neots HUNTINGDON Cambs PE19 2AF
Tel (0480) 215005 Telex: 32514 Comart G.

What are Ingersoll and Canon doing at the 1981 Micro Show?

- both have booked big display areas
- both will do a lot of business

If your company is not represented you had better ask why.

9,000 visitors, mostly business people, flocked to Wembley for last year's event and many exhibitors reported record sales.

Following this success, twice the exhibition area has been made available for the 1981 event - 3,000 square metres on two levels. Organisations who have not yet booked are advised to telephone the Online Exhibitions Department who will make a provisional booking for your company awaiting your written confirmation.

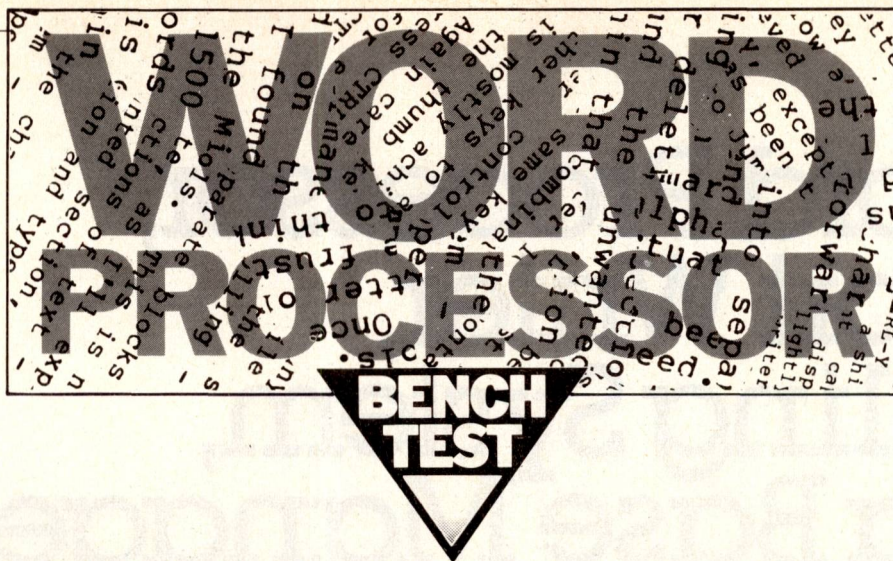
Exhibition: 30,31 July, 1 August

Associated Seminars

Thursday 30 July	Small Computers in Business
Friday 31 July	Microcomputer Technology Advances
Friday 31 July	Micros in Education



<i>online</i>	PCW
Please send me details of the 1981 Microcomputer Show	
☐ I may wish to exhibit	
☐ I am interested in attending the seminars	
Name _____	
Company _____	
Address _____	
Telephone _____	
Please return to: Online Conferences Ltd. Argyle House, Northwood Hills, Middx. HA6 1TS. Tel: Northwood (09274) 28211 Telex: 923498	



FORMAT-80

This month Peter Rodwell looks at an Apple-based WP system

The Apple II is one of the 'old faithfuls' of the micro world; it has been around for ages (or so it seems) and is one of the world's top-selling machines. This means that programmers and retailers have had plenty of time to get used to its quirks and that plenty of companies have been able to produce hardware additions to plug into the slots provided inside the case for this purpose.

The result is that, no matter how weird your application, it's quite probable that someone, somewhere has produced a piece of hardware and/or software to do the job on an Apple.

Word processing isn't, of course, a particularly weird application but the standard Apple II is not really suited to the job, mainly because of its 40-column screen and its lack of a true, typewriter-action shift key. (And please don't write in to say that you find 40 columns perfectly adequate for WP; either you haven't tried an 80-column system and don't know what you're missing, or you're not processing lots of business-type words.) Both these drawbacks can be overcome, though; there are several 80-column plug-in cards for the Apple and a proper shift function can easily be fitted. All you need now is the WP software.

This review is of a twin-disk Apple II Europlus, fitted with a Computer Stop 80-column card. The software package is Format-80, produced in-house by Apple specialist Personal Computers Ltd (no relation to this magazine). The package is an all-in-one editor and formatter which, as a bonus, includes a mailing list handler.

Editing

Format-80 is loaded simply by slotting the disk into drive 1 and switching on the Apple — it loads and starts running automatically. The disk, incidentally, is copy protected, which means you can't make a back-up copy and have to go back to Personal Computers if the master disk fails.

After loading, you are presented with a master menu which allows you to initialise disks, view the disks' directories, load, save, replace or delete text files on disk, print text or work on the mailing list. Additionally, there are two editing commands, one for 'old' text (ie, text already in the Apple's memory) and one for 'new' text, which means what it says.

Format-80 calls each text file a 'page', which means a memory-full of text rather than a printed page. The maximum page size is 80 lines long, which means just over 900 words will fit into each file. Once you've filled a page, you must save it to disk and continue on a new page.

The editor offers two modes of operation, text entry and format. In the text entry mode, everything you type appears on the screen; the system has word-wrap built in so there's no need to hit return at the end of each line — the word you're typing is transferred to the start of the next line if it won't all fit in. As well as word-wrap, Format-80 has automatic hyphenation built in, although this seems a little timid; in theory, it should hyphenate words correctly at the end of each line and only perform a word-wrap if it can't find a suitable place to put a hyphen, but in practice, over a lot of text editing, it only hyphenated twice and got both of those wrong ('pocket-sized' came out as 'pocket-sized', for example). The hyphens, incidentally, are 'ghost' hyphens, which don't appear on print-out.

You can move the cursor back to correct mistakes, using the back-arrow key, but the forwards arrow key provides a tab function since there's no tab key on the Apple's keyboard. Tab positions can be set while in the entry mode, the positions being shown by little arrows above and below the text area on the screen. Right and left margins can also be set and these are shown by white bars above and below

the text. There's a column counter at the top of the screen to help set margins and there's also a line counter.

A shift lock is provided by pressing control and shift together and is unlocked by pressing shift, an action as close as it's possible to get on the Apple's keyboard to that of a real typewriter.

You enter the format mode by pressing escape, which has a toggle action; the screen tells you which mode you're in, which is important because in format mode, nearly every key activates a command. 'Format' is actually a slight misnomer — quite a few of the commands are editing commands.

The format mode gives complete cursor control: the ← and → keys function as expected, while up and down movements are also available. You can also move the cursor to the following word, line, sentence, paragraph or text block, jump to the start or end of similar locations or scan backwards or forwards through text at variable speeds to check it. The Apple has a repeat key, a must for cursor movements.

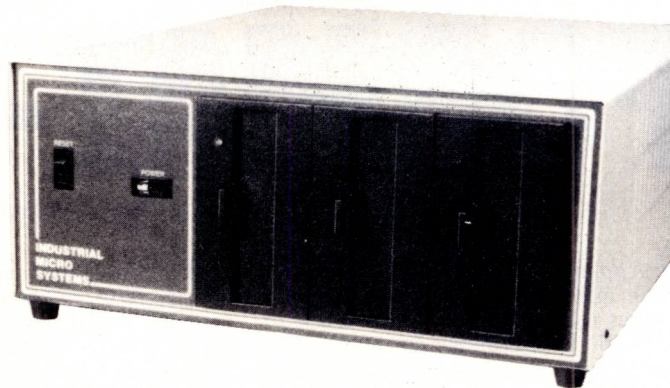
Text can be inserted at the cursor position and a simple, one-character delete function is activated by hitting the 'X' key. More elaborate deletion is also provided, operating on line, paragraph and all text and there's a blank command which differs from delete in that a blank space is left in the text, while delete closes it up.

There's a find command, which positions the cursor at the start of the sought text and there's a search and replace facility, oddly called edit, which is rather more intelligent than that on other machines: suppose, for example, you want to replace 'the' with 'some' throughout your text; unlike many other word processors, Format-80 will also act on 'The' and 'THE', replacing them with 'Some' and 'SOME', a very useful feature indeed.

A block move command is available, which allows you to place a block in a reserved part of the Apple's memory and recall it later for insertion at any desired place in the text.

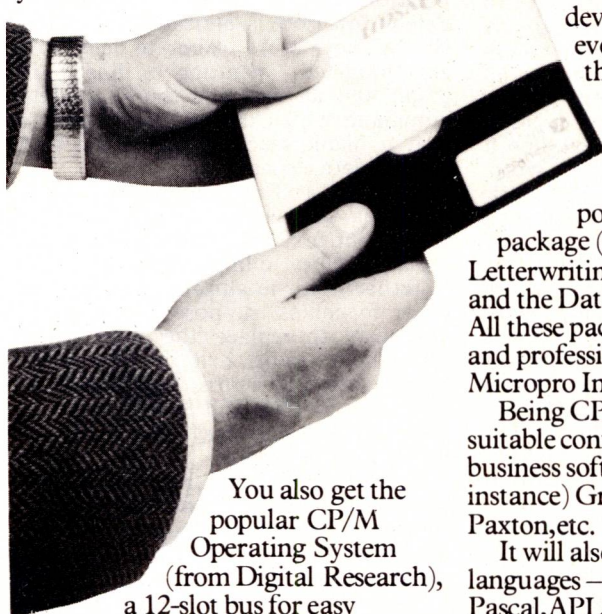
Format-80 provides a useful range of editing commands, then. The only real criticism I would want to make is of the amount of key pressing needed to activate them. To delete a line, for example, when you're busy entering text, you must press escape to get into the format mode, then D for delete

A Word Processor, Report Writer, Mailing System, Data Base Manager, and a Computer all for £1995*



Yes, we are offering all this with our SERIES 5000 5" floppy-disc system for the incredibly low price of £1995.*

Not only do you get a powerful Z-80A system on the S-100 bus built to high quality standards by Industrial Microsystems, one of the longest-and best-established companies in the microcomputer industry, and supported by Equinox, specialists in microcomputers and multi-user systems.



You also get the popular CP/M Operating System (from Digital Research), a 12-slot bus for easy expansion, a Z-80A CPU for powerful performance, 2 serial and one parallel interfaces, 64KB of dynamic RAM with in-built error detection capability,

and dual 5" double-density drives with the option of a third drive (or quad capacity drives in place of double-density) in the same cabinet. Additionally, there is the Turbocharger option providing both enhanced disc capacity, disc performance and diagnostics. And if even greater storage is required we can supply 8" floppy drives and cartridge disc drives.

A powerful system for the computer-user and system developer – and one with eventual access to OS/2000, the Industrial Microsystems networking system.

And for the office or business user we are including as standard a powerful Word-Processing package (Wordstar), a Mailing and Letterwriting package (Mail-Merge) and the Datastar Data Base Manager. All these packages are widely accepted and professionally written by Micropro International.

Being CP/M based, the system with suitable configuration will also run the business software developed by (for instance) Graffcom, Peachtree, Paxton, etc.

It will also run a wide range of languages – Basic, Cobol, Fortran, Pascal, APL, Algol, C.Lisp, and Forth and will support a wide range of add-on S-100 devices, such as floating point processors, Prestel interfaces, speech synthesisers, digitisers and plotters, etc.

And just to make certain that you get full use out of your system, nationwide field service support is available at a modest extra cost.

*add VAT and the terminal and printer of your choice at the costs shown.

Series 5000 with 64KB Dynamic RAM, dual 5" double density drives, CP/M Operating System, Wordstar, Mail-Merge and Datastar £1995

The same system with quad drives in place of the double density drives £2230

Add-on double density drive £290

Add-on quad drive £405

Peripherals:

Televideo 912C VDU £595

Elbit 1920X VDU with Wordstar keyboard £895

OKI Microline 80 printer £595

Texas 810 150cps printer £1450

NEC Spinwriter RO Word processing printer £1850

All prices exclude VAT, carriage, training and installation and are subject to our standard terms and conditions.

OEM dealer and educational enquiries welcome.

EQUINOX
COMPUTER SYSTEMS LIMITED

Kleeman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB
Tel: 01-739 2387/9 & 01-729 4460

Saving text to disk is quite straightforward. Each page of text must be given a name and a number so that a document can be split into several pages — 'Text 1', 'Text 2', etc. Format-80 won't let you save a page with the same name and number as a page already on disk — you have to use the replace command instead, so there's little chance of accidentally over-writing your previous efforts. Each disk can hold up to 17 900-word pages. One annoying omission is a disk-to-disk copying command, so backup copies have to be made by loading individual pages from one disk into the Apple's memory and then saving them onto the other disk.

Format-80's formatting is a mixture of pre-set system parameters and embedded commands. The embedded ones are entered while editing, using the format mode, and have an immediate effect – you can see what you've done and undo it if it's not what you wanted. In this way you can centre lines, justify text, close up blank spaces, insert printer codes, de-justify, underline, slide lines up and down and slide words left and right. You can also align numbers by decimal point, which is handy, although Format-80 contains no mathematical functions for adding columns of figures. (One of the nice things about reviewing Format-80 was that, as it's a British product, its author Mike Hardwick was but a phone call/tube ride away. The reason for not including maths functions, he explained, was that he felt that such functions shift responsibility for the figures away from the boss to the secretary. I see his point, although I'm not sure I agree that such a shift is always a bad thing.)

You can print either the text in memory or one or more pages on disk and multiple copies are catered for. There is no facility for previewing the text on the screen in its final format, with pagination, headings, etc.



Line: 1 (80) Position: 10 Enter Text

About six Years ago, writer and word-Games addict CY Endfield, an expatriate American living in London, bought one of the early Pocket calculators. It struck him that a calculator-sized device with an alphanumeric keyboard would make the ideal basis for a word-Game he'd invented - but he didn't like the idea of a full keyboard with one key for each letter of the alphabet. It would be too fiddly, he thought.

Thus was born the idea for the Microwriter, a device which would allow you to type alphanumerics using just one key for each finger and pressing them in various combinations to produce the required characters.

There was a Problem, though. To do this you'd have to memorize the key combinations and that seemed an almost impossible task to ask of anyone. Also, decoding the key combinations and producing characters from them seemed rather complicated.

Two innovations changed this. Firstly, the development of microelectronics - and, in particular, the availability of low-cost CMOS chips - made the decoding task easy. And CY himself solved the key combinations Problem by hitting on the

```
Mailings list : Initialise Universal Labels Entries Main menu

[S][Q] Label : Entry :
      $name       Miss J Mannleigh-Thise
      $address     Flat 27
      "            Rodwell House
      "            47 High Street
      $town        Anytown
      $Postcode    SO4 1FF
      $salute      John

General entry : Entry Find move Delete Blank : _
```

Top: the system as tested; centre: part of a text page during entry — the white bars show the margins; bottom: an entry in a mailing list, with labels.

Format-80 contains a mailing list handler which allows you to build up and manage a file of up to 442 names and addresses per disk. Each line of each entry can be given a label and lists can be sorted by any of these labels; you can also create a standard letter incor-

The version of Format-80 tested was a pre-release version and had one or two features yet to be finished; one of these was a logical function which will

allow, for example, selective printing of names and addresses depending on the contents of the labels' fields. Thus you could print 'personalised' letters to every solicitor in Birmingham whose name wasn't Smith, for instance.

There are facilities for reviewing, altering and deleting records in the list and for initialising disks. This last function is a little awkward as it doesn't allow you to initialise an unwanted text disk for mailing use — you have to initialise the disk using the Apple disk operating system and then re-initialise it from the mailing list section of Format-80.

Documentation

As the tested version of Format-80 was incomplete (as well as the mailing list logic, a whole-document word search and replace function hadn't been implemented), the accompanying documentation was also preliminary, taking the form of an 11-page 'First-guide'. This briefly explained most of the package's features apart from the mailing list and was intended as a very quick introduction to the system. By the time you read this review, the final version of Format-80 should be ready, complete with a 200-page manual which, in view of the high standard of the software, I would expect to be very good.

Users

How, then, could Format-80 appeal to our four user groups?

As I said last month in my review of Wordpro 4 Plus, being a member of the author/journalist group, I don't find a system which enforces the splitting of documents into a number of separate files particularly convenient to use. If you weren't bothered by this, though, the system contains all the editing and formatting functions you're likely to need. Public relations-type persons might find it particularly handy for writing and mailing medium volumes of press releases.

The report writer would also find the system limiting, but to a lesser extent than an author, although the formatting commands — of great interest to this user — are not particularly powerful. The system does, however, allow good printer control, so fancy typefaces, etc. could compensate for this.

For the manager or small business-

man, Format-80 could prove a valuable tool; like Wordpro on the SuperPET, it gives you a useful WP system while allowing the computer to be used for other things — there are certainly plenty of good business software packages available for the Apple.

Secretaries would feel very at home with the system. One of the main considerations in the package's design has been to make the hardware as much like a normal typewriter as possible, in terms of the way it's operated, while taking advantage of the features which only a WP can provide. This is as it should be, for a word processor is a piece of office equipment, not a computer, and should therefore be as user-friendly as possible. Format-80 is friendly and would make a useful general office tool.

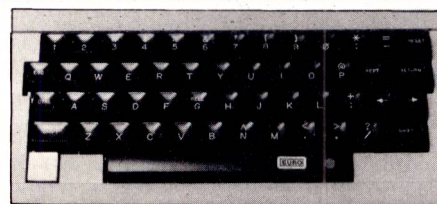
Hardware

As I said at the start of this review, the Apple has been around almost since the dawn of the microcomputer age; it's a well-proven, well-known machine with a good reputation for reliability and has a well-built, quality feel to it. If it does go wrong, then there are plenty of people around to help you out.

For word processing, I found it quite pleasant to use. The keyboard felt a little cramped as it's slightly smaller than that of a standard typewriter, but the keys have a nice solid feel to them. A major horror when using the Apple as a computer is that of accidentally hitting the reset key when you intended to hit return, thereby destroying the program in the memory; with Format-80, hitting reset merely puts you back to the master menu and leaves the text in memory unchanged.

The modification to provide a true shift key is very simple and Personal Computers will do it for free if you buy either a complete system or just Format-80 from them; if you can't take your Apple along to have the mod done, PC will supply a circuit diagram, instructions and telephone advice for you to either do it yourself or have it done by a local dealer. The mod includes a switch at the rear of the machine to restore the Apple's normal shift function, should you also want to use it as a computer.

The output from the Computer Stop 80-column board is of good quality, although there are no true descenders on letters like 'p' and 'g'; the display actually has 81 characters on 25 lines.



The Apple's keyboard

You may have noticed that I haven't mentioned a printer so far in this review. Personal Computers supplies a choice of daisywheel printers for quality output, including the new Olympia 17 cps machine; unfortunately none of these was available for the test period and a Centronics 703 dot matrix unit was supplied instead. This defied my attempts to get it to work so printing was done on my Epson MX-80, which was reviewed in the Magic Wand test in May.

Summary

Format-80 is a friendly, well-designed word processing package which provides a useful range of functions for general office/small business use. It would appeal most to small business users, especially those wanting to use their Apples for other purposes. It's a particularly helpful system, with menus and sub-menus for almost every command, although the penalty paid for these is that you have to make more keystrokes to activate some functions than are necessary on other systems.

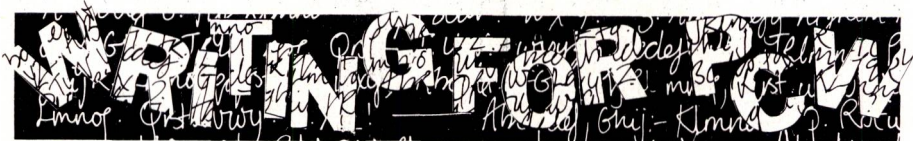
The Apple in the configuration tested is a pleasant machine for word processing, has a good reliability record, plenty of service backup across the country and can be used for many other applications.

Finally, because of the system's 900-word maximum page capacity and the lack of the document-wide search and replace function on the version tested, it wasn't possible to run any of our WP Benchmarks.

Prices

48k Apple II with twin disks and monitor	£1664
Computer Stop 80-col board	175
Format-80	300

Prices exclude VAT and are those of Personal Computers Ltd, whom we would like to thank for the loan of the hardware and software tested.



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number

appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind

but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading PCW will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — PCW does pay for all published work.

Technology leaps ahead with the Vector Graphic 3005 from Almarc



Almarc bring you the latest in micro computer technology. The 3005, 5.6 Mega byte hard disc system from Vector Graphic for the price of an 8" floppy disc system.

The 3005 represents the latest technology in desk top systems with the speed, capacity, convenience and reliability of State-of-the-art Winchester hard disc technology.

Ask Almarc about the 3005 and other Vector Graphic systems in the range. Full sales and servicing

facilities are available throughout the U.K. Specification includes:

- * A nearly silent 5¼" 5 Megabyte Winchester hard disc.
 - * A 630K byte double-sided, quad density floppy drive.
 - * The Vector 3 intelligent terminal.
- Also the standard software package supplied with all Vector systems: CP/M 2.-2, Microsoft Basic 80, Scope (Editor) and Raid (Debugger).

Almarc

DATA SYSTEMS

Almarc Data Systems Ltd., 906 Woodborough Road, Nottingham NG3 5QS.
Nottingham (0602) 625035 Telex: 37407 Almarc/G

New! Sinclair ZX81 Personal Computer.

Kit: £49.⁹⁵ complete

**Reach advanced
computer comprehension
in a few absorbing hours**

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. At £99.95, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

Lower price: higher capability

With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

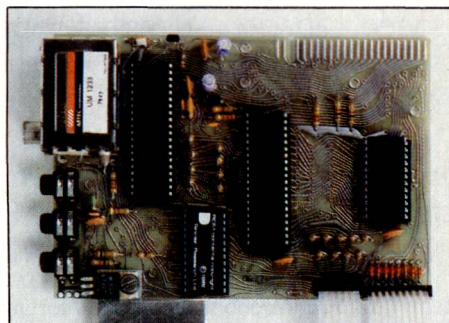
The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

**Built:
£69.⁹⁵** complete

**Kit
or built –
it's up to you!**

The picture shows dramatically how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

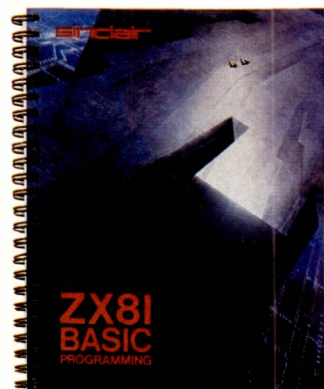
Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



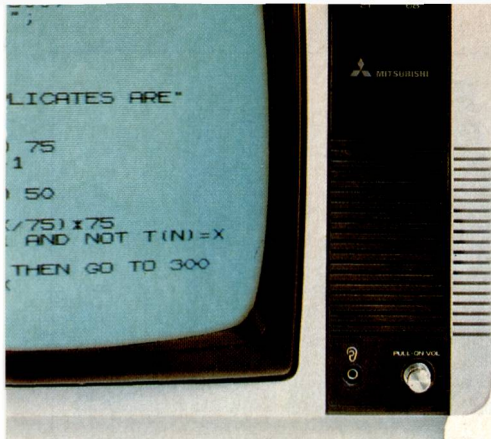
Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.



New BASIC manual



Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.



If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon – the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics across 32 columns, and highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!



16K-BYTE RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.



How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard. EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

New, improved specification

- Z80 A micro-processor – new faster version of the famous Z80

chip, widely recognised as the best ever made.

- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tire-some typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.

- Unique syntax-check and report codes identify programming errors immediately.

- Full range of mathematical and scientific functions accurate to eight decimal places.

- Graph-drawing and animated-display facilities.

- Multi-dimensional string and numerical arrays.

- Up to 26 FOR/NEXT loops.

- Randomise function – useful for games as well as serious applications.

- Cassette LOAD and SAVE with named programs.

- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.

- Able to drive the new Sinclair printer (not available yet – but coming soon!)

- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

sinclair

ZX81

Sinclair Research Ltd,
6 Kings Parade, Cambridge, Cambs.,
CB2 1SN. Tel: 0276 66104.
Reg. no: 214 4630 00.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY.

		Order		
Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

Please tick if you require a VAT receipt ☐

TOTAL £

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable.

Please print.

Name: Mr/Mrs/Miss

Address

FREEPOST – no stamp needed.

PCW08

PASCAL

READERS WRITE

Chris Sadler presents further feedback following his proposed series of Benchmarks.

I read your Pascal Benchmarks article (PCW March) with interest as I am considering buying a Pascal compiler/interpreter. As I have an S100 machine running CP/M I thought I might obtain a few useful comments from your correspondent Mr C J Neville and I have therefore enclosed a letter which I would be extremely grateful if you would pass on to him. I would welcome your comments.

Russel Gadd, Southsea, Hants

As far as I know, there are five possible compilers available under CP/M. Although I haven't had much experience with any of them and have never even laid my hands on two, I do have a bit of information (mostly hearsay, gossip or manufacturer's claims). Any reader who can add to (or correct) these impressions with actual experience as a user of one or more of these is invited to write in.

TCL Pascal is produced by TCL Software and is a wholly British product. It compiles into p-code and is said to meet the Pascal standard. It runs in two modes (see elsewhere in this article) with the compiler either memory- or disk-resident; the former of these is easier and faster to use but restricts the possible size of the user program for a given amount of memory. It is also relatively cheap compared to the other CP/M (Pascal) compilers.

Pascal-M (from Sorcim) also compiles into p-code and is supposed to be very close to UCSD Pascal — so much so that programs can transfer almost directly, but I cannot tell what the 'almost' entails as I've never actually used this system. Apparently a version of this runs under CP/M 86 (CP/M on the 8086) so that upgrading to a 16-bit system ceases to be a problem.

Pascal-Z (from Ithaca Intersystems) compiles to macro assembler. This enables Pascal source programs to be run with machine code or other language routines patched in. Judging by our timings, however, the arithmetic is really slow and I believe that Pascal-Z is probably further from the standard than the others are.

Pascal-MT+ (from MT Microsystems) compiles to native code and has the advantages of being capable of directly producing ROM-able code

(although some of the others may do this) and of being able to utilise the AMD 9511 maths chip (I don't think the others can do this) which should keep the number-crunching programmer happy.

MS-Pascal is the new Pascal from Microsoft. It also produces native code and Microsoft is apparently 'committed' to keeping to the standard. I've never used this one but I'm told that it operates on three levels: level one is written to the ISO standard; level two has the sorts of extensions found on the UCSD system (eg, random access files, string-handling) and a bit more; the level three is 'system' Pascal.

Prices are: TCL Pascal £120, Pascal-M £195, Pascal-Z £205, Pascal-MT+ £250, MS-Pascal £195.

I enclose a table of Benchmark timings for UCSD Pascal on the North Star Horizon (which is, of course, a Z80A, 4 MHz rig). All timings were obtained using a digital stopwatch running each Benchmark three times and averaging the result. To assist timing, the modification proposed by Dr John Rostron was adopted.

When we attempted to run Benchmark 'maths' we obtained, as did Dr Rostron, a floating point error. This is due to attempting to calculate EXP(90) and not EXP(1000) as the good Doctor suggests. This brings me to an interesting point: how have those other UCSD times for program maths been obtained? If the contributors had to modify the program, would they let us know the source code so that we may run a fair and impartial test?

Keith E Gould (on behalf of Plymouth District Amateur Computing Club)

Thank you for your timings. I hope that, by now, you will have spotted the modification (published in March PCW) which makes maths run correctly.

With reference to the relatively slow timings for TCL Pascal running on the Commodore PET, can we make the following points?

1. This compiler had to be extremely compact to run on a standard 32k PET. Hence some loss of speed.

2. It can only be compared fairly against the other 6502-based machine, Apple running UCSD Pascal in a minimum of 48k. It cannot obviously be compared for speed when the machines are 16-bit or even against Z80-based machines with full 16-bit stack pointer.

3. Please accept our timings for the CP/M version running on the Tuscan microcomputer.

It may be of interest to your readership that TCL Pascal for PET and TCL Pascal for CP/M has now sold over 2000 copies worldwide since the launch of the product in July 1980. We have also concluded two major OEM contracts for parts of the source code. Not bad in six months?

The book of TCL Pascal is being launched in June 1981.

Also, as a final thought, many PET owners will be pleased to know that TCL Pascal for the 80-column PET is nearly ready and should be available from TCL Software or PET dealers in late March 1981. This means there will be three versions: the 3032, 4032 and 8032 in the new V1.6 release. Graham Clifton, Director, TCL Software.

Of course you are right, account should be taken of the relative 'size' (word-size, memory, clock speed and architectural features) of the machine on which the Benchmarks are run and I withdraw my previously-stated disappointment. As a user, it is important to know not only where your system stands in relation to others but why.

The enclosed times were recorded for TCL Pascal under CP/M. As both a resident mode and a compiling mode are offered, both were timed. For the compiling mode the fastest option, which suppresses error checking, was used, but as the TCL Pascal only compiles to p-code rather than native Z80 or 8080 code, the timings are rather slow.

For the resident mode there is an overhead of 14.2 seconds to load the compiler (8in single-density disks) but this is only required once per Pascal session.

I found, incidentally, that TCL Pascal will not run under CP/M 2.2, only under CP/M 1.4. Peculiar things happen like

getting extra characters on input under 2.2 that work correctly under 1.4. Other programs do not behave in this way. Do any of your other readers find this?

Although I like Pascal as a language, the development system I tend to use is the Microsoft Basic Interpreter/Compiler combination. Interpreting is a most satisfactory way of debugging a program — extra lines can be quickly added and particular variable values printed at the console, whereas the compiled version will run at high speed. Compiled Basic on my system runs more quickly than interpreted Basic on a Tektronix 4052 'High Speed' desktop computer.

On my S100 system I use an Ithaca Z80 CPU card running at 4 MHz with one wait state, 64k of Expandoram dynamic memory, and a variety of other goodies including a fast video digitiser with the 6-bit TRW chip, the Micro-Angelo graphics display with its own 5 MHz Z80B and 32k RAM, four A-to-D channels, three D-to-A channels and a GI sound generator and Nat Semi's time-of-day clock.

From your timings it looks as though either the S100 Microengine board or a Z8000 board will have to be a future addition to my system but could I also appeal to some software house to do for Pascal what Microsoft has done for Basic, and bring easy development to a fine language.

David J Taylor, Edinburgh

You certainly seem to have a very fancy system and I can see why you'd like a very flexible development 'environment' to help you to marshall all your features and facilities. I would have thought, however, that the opportunities offered by Pascal for minimising logical and declarative bugs would outweigh the ease with which these problems (more prevalent in Basic) can be ironed out with an interpreter. I wonder if you have ever considered the UCSD p-system which is billed as a 'program development environment'? — when its compiler finds an error it offers the option of carrying on with the compilation or dropping you straight into the editor at the offending line.

Now you have corrected your Pascal Benchmarks, I have run them on our Cyber 174 mainframe, with Pascal3, the latest version of Wirth's original CDC compiler. At first sight these don't show the advantage of a very fast floating point processor. But despite their names, realarithmetic and realalgebra are tests of integer arithmetic and integer-to-real conversion! This isn't good enough! The tests show the stupidity of current Pascal compilers even on mainframes, for any Fortran optimising compiler would notice the inner repeated statements could be taken outside the do-loop.

My motivation for running these Benchmarks was to assess the relative power of 16-bit micros, such as the Onyx. There is a considerable debate as to how much serious scientific computing can be done on micros. During the day in term our mainframe supports about 140 users on two CPUs and many peripheral processors. Even under those conditions, the user has more power available to him than any of the machines in your table except perhaps the Microengine. It would appear to be some time before the scientist's dream of a personal computer to do all his computations will be realised.

We are about to enter the word processor age but the need for many mathematical symbols ruled out a micro-based solution there, too. Dr B D Ripley, Dept of Mathematics, Imperial College, London

I'm not too sure what point you are making with regard to realarithmetic and realalgebra. The process you describe would certainly occur if the crucial assignment statements were indeed Fortran statements, but, as I understand it, a Pascal compiler would make the integer-to-real conversions first (at compile-time in the case of realarithmetic, at run-time for realalgebra) and then evaluate the expression in 'real' terms for assignment to the real variable. Maybe that's more 'stupid' than an optimising Fortran compiler would be but the first optimising Pascal compiler to be produced is certainly going to show up in the Benchmarks.

I've given quite a bit of thought to your remarks about mainframes versus

micros. I think you are right that a mainframe environment can provide special hardware (like your floating point processor), specialised software and expert personnel — just the kind of computing power a research scientist might want and at a price only the research scientists can afford. However, there are other kinds of computing power (like flexibility, availability, portability, even personal ownership) which appeal to other people (including research scientists with possible less computationally onerous tasks) and at costs which are more attainable.

Incidentally, there are at least three micro-based solutions to your word processing problems — Wordcraft (with the scientific option) on the PET, Wordstar on any system with a programmable character generator (eg, Cifer 2684) and the AVTEK 1800. These are the ones I know of — perhaps there are others.

It is interesting to receive timings for a mainframe — I have heard rumours that there are several systems (mainframes and minis) with our Benchmarks lying around on them but whose figures have not seen the light of day — come on, there's plenty of room in the table. My thanks also to P S Bott of Harrogate for his table of timings for the North Star Horizon using the UCSD p-system. Don't forget about the UCSD Users Society (USUS(UK)) conference at Westfield College (11-12 September). Details from Malcolm Harper, Secretary, USUS(UK), 45 Banbury Road, Oxford OX2 6PE.

This is timed to coincide with the PCW Show and delegates will be able to book accommodation (and get half-price show tickets) from the night of 9 September, to attend the Show on the 10.

Stop press: I have received (too late for inclusion) a letter about NASPAS — Pascal on the Nascom — and have discovered Pascal on the Acorn Atom. I shall investigate both of these for a future article.

If you have a contribution for Pascal Benchmarks, sent it to Chris Sadler, c/o PCW, 14 Rathbone Place, London W1P 1DE.

PASCAL BENCHMARKS SUMMARY

Benchmark	System/software	PDP 11/04 (OMSI)	(with floating point)	Onyx/UCSD	Microengine/UCSD	Heath H11A/UCSD	TRS-80/Boume	Horizon/Midas	Horizon/Pascal Z	Tuscan/UCSD	Ithaca/UCSD (compiling)	Ithaca/UCSD (resident)	Apple/UCSD	PET/UCSD	Cyber 174
magnifier	0.3	0.5	0.8	3.9	2.2	2.4	3.5	4.5	5.0	5.8	6.4	9.5	0.1		
forloop	3.3	6.1	9.5	42.8	26.6	29.3	38.5	56.2	62.6	69.7	74.3	119.0	0.6		
whileloop	2.5	5.9	9.3	40.1	28.6	29.9	35.0	66.5	74.4	99.0	70.0	158.0	0.8		
repeatloop	2.2	5.4	9.1	35.0	26.4	29.3	31.2	62.1	69.1	107.7	63.3	168.0	0.8		
literalassign	3.9	6.7	11.0	49.9	29.5	30.3	44.8	67.6	75.3	83.8	88.5	149.0	0.8		
memoryaccess	4.3	4.2	6.9	11.4	52.0	31.2	31.4	46.0	70.1	77.7	86.8	91.0	155.0	0.9	
realarithmetic	58.0	42.8	—	8.7	61.7	—	192.9	47.2	69.4	80.0	83.1	93.0	164.0	0.3	
realalgebra	53.3	38.2	—	6.8	40.6	—	127.9	44.7	51.7	59.4	62.3	83.4	156.0	0.3	
vector	9.4	22.7	26.4	102.9	72.2	51.6	96.4	154.1	172.5	201.2	203.3	532.0	1.2		
equalif	5.3	9.9	16.0	66.8	46.1	33.9	58.8	104.1	115.7	149.1	116.7	240.0	1.6		
unequalif	5.2	9.9	15.8	65.8	45.9	33.4	58.4	101.1	112.5	140.5	115.3	231.0	1.4		
noparameters	3.0	7.4	4.5	26.4	21.4	13.7	20.7	28.3	31.3	48.2	50.2	66.0	1.9		
value	3.9	8.0	5.0	29.3	21.7	14.2	23.9	31.7	35.1	52.4	54.4	75.0	2.0		
reference	3.9	7.9	5.0	29.7	—	15.0	24.2	32.4	36.1	53.3	55.3	77.0	1.9		
maths	21.6	—	7.0	25.3	—	314.2	23.6	—	206.9	219.7	66.0	—	0.2		

Timings are in seconds, rounded to nearest 0.1 sec.

CODIFIED COMPUTER SYSTEMS

DAI

£595 Personal Computer with high specification & "real world" expansion.

Easy to program 16 colour graphics with sound.
Socket for printer on RS232 port, also stereo output.
DAI "real world" industrial control Eurocards plug into the DCE bus.
The machine has 48K and a thriving user group is providing software.
As the CPU is the 8080, CP/M (TM) and discs arrive in a couple of months.

OSCAR

£2495 British made commercial computer (with 800K diskette storage)

By Interactive Data Systems of Milton Keynes. Providing as standard 64K, Z80 CPU card with 2 serial ports and 2 spare slots in its S100 bus. Discs are 8", 5" or Winchester. The CP/M operating system means that a mass of written software and facilities are available in addition to the supplied software for sales, purchase & nominal ledgers plus payroll.

PERT

£205 Program for PETS. 1200 activities under 400 cost codes

Keyboard entered networks give a critical path, fixed & free float and earliest/latest start/finish times. Reports (screened or printed) give activities in node/calendar sequence, with float selection by cost code and period. Activity costing & targeting included. Demonstrations available.

S100 Cards

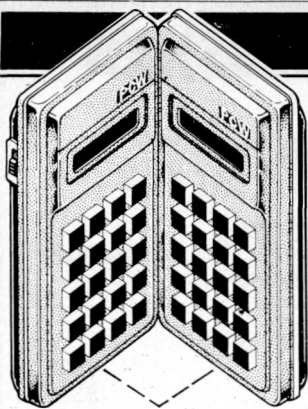
Interactive Data Systems

£235	SBMC	An S100 single board microcomputer card with 4MHz Z80A, 1K RAM, sockets for EPROM, 2 serial ports, Z80 CTC.
£105	Z80 CPU	A 4MHz Z80A CPU card with the S100 interface circuitry.
£450	64K DRAM	64Kbytes dynamic RAM (4116) with bank select, 8 or 16 bit operation, each 4K block deselectable, 24 bit addressing.
£198	16K SRAM	16Kbytes static RAM (low power 2114's)
£114	8K SRAM	8Kbytes static RAM.
£198	D.F.D.C.	Floppy disc controller, single/double density, single/double sided mixed 5¼" and 8" drives, up to 4 in total.
£223	PCI 10	A mixture of opto-isolated, analogue and TTL inputs; relay, analogue and TTL outputs.
£32.50	TERM 40	Active Termination Board.
£265	VID 1	I/O mapped V.D.U. controller with Centronics printer port.
£155	PSU	Complete S100 power supply.
£88	PSUC	Power Supply Card.
£75	PSUT	Power Supply Transformer, bridge, capacitor, cables.
	Dual	
£135	CLK-24CPU	An S100 real time clock-calendar card with a battery on the card giving a typical readout like THURS 8-1-81 3:55:21
£355	AIM-12	An S110 A/D card with 16 or 32 input channels giving 12 bit resolution and accuracy.
£245	AOM-12	An S100 D/A card with 4 output channels/actuators with an accuracy of 12 bits +/- 0.5Lsb.
£165	4K CMEM	An S100 CMOS 200ns memory card working at 4MHz. The battery back up will enable data or program to be held for up to a year.
£290	8K	
	Matrox	
£176	ALTR2480	An S100 TV CRT controller displaying 24 x 80 of alpha or graphic data.
£235	ALT256	An S100 256 x 256 graphics controller stackable for multiple grey/colour effects using X-Y addressing
£343	ALT512	As the card described above but 2 graphics modes, 512 x 256 or 256 x 256 x 2 giving live animation effects.

**15 Newington Green,
London. N16. Tel. 01 254 7419**

Micro Computer systems,
S100 IEEE Cards & Peripherals.

Codified Computer Systems
supply British in London.



CALCULATOR CORNER

Compiled by Dick Pountain

EVEN QUICKER COMPUTATION ON THE CASIO

Just after I sent my last column to press, I received a long treatise from Michael Leigh of Salford which contained much of interest concerning the Casio fx 502p. In particular, it contained the full algorithm for subtraction of alphanumerics plus a very full rationale for the concatenation of alpha characters. This material, however, is rather technical, involving truncated adders and shift routines, and moreover it duplicates much of what I said last month, albeit more rigorously.

I've extracted a part of Michael's article which deals with the Casio's jump and subroutine destination searches, suggesting program structure for optimal execution speed. This is printed below.

Before launching into these, I shall present Michael Leigh's algorithm for alpha subtraction in the same notation used in last month's addition algorithm for the sake of consistency.

Take as our example 92E-C1.

a) Express as strings of place values: ie, [09][02][13] and [12][01].

Subtraction always proceeds by taking a shorter string from a longer string, and if of equal length, then the one with the lesser value from the greater value in the leftmost (most significant) place:

ie, [09][02][13] - [12][01]

[09][12][12]

Had our example been C1 - 92E, we should still proceed as above, but the answer would be negative.

b) Wherever a place result is less than 0 or greater than 9, carry a 10 from the next place on the left and subtract one from this place. Do this starting at the rightmost place:

[09][12][12]

then [09][11][22]

then [08][11][22]

Note that the criterion for a carry applies to the value *after* any carry from the right has been subtracted so that [10][11]

[09][21]

stops there as the second place is not now greater than 9.

c) Any place which now exceeds 15 or is still less than 0, is adjusted by adding or subtracting 16 to put it in $0 \leq x \leq 15$. ie, [08][11][22]

+16 -16

[08][15][06]

d) Translate back. Values 0-9 are numeric, 10-15 are alpha.

So [08][15][06] = 8 () 6

which is the displayed answer, ie, 92E-C1 = 8 6.

The only complication comes when the result in the leftmost place falls negative or greater than 9, ie, requires a tens carry. In this case a 10 may be carried in from one place further to the left by writing a [00] as follows:

EP-20 = [13][11] - [02][00]

[00][11][11]

[00][10][21]

[-1][20][21]

[09][20][21]

-16 -16

[09][04][05] = 945.

Whereas EP-30 = [13][11] - [03][00]

[10][11]

[09][21]

-16

[09][05] = 95.

This extra tens carry is limited to one place as shown and results in a leading 9 in the answer, which has one more digit than the subtrahend.

Incidentally this process makes sense of the way the 'magic number' - $\beta\beta\beta\beta\beta\beta\beta\beta$ converts strings. It does not, as I wrote last month, violate the addition rules, but complies with the above subtraction rules, since the magic number is negative! I accept a slap on the wrist.

Casio program structures

It has been noted in previous articles that the alpha characters $\square$, P, C, E, -, (), may be used as indirect addresses for the INV IND, GSBO command, control passing to the first 0, 1, 2, 3, or EXP respectively encountered in the program stack, execution commencing from the next step. While this technique is only likely to be of use in the one-off situation, it points to the clear need to understand the way in which the program stack is structured. This article is therefore devoted to programming techniques which may be used to speed up processing time. They are particularly relevant, therefore, where response time is important, eg, games, iterative statistical computations, function evaluation, equation solving routines.

Subroutines

Subroutines may be used to reduce the length of and hence simplify a program listing. Use of subroutines, however, can have a marked effect on execution time and if carefully placed can reduce execution time - unfortunately the con-

verse also holds true. When a GOSUB command is encountered, a search is initiated from the *beginning* of the stack. This gives us the cardinal rule:

1) The most frequently used subroutines should be placed at the bottom of the program stack. To this we may add;

2) Shorter subroutines should be placed as low in the program stack as possible.

The combination of these rules results in a trade-off where if P0 has length L_0 and is to execute N_0 times and P1 has parameters L_1 and N_1 , then if $L_0 N_1 > L_1 N_0$ then L_1 should take precedence over L_0 .

The program stack is built up according to the following rules:

1) The program sequence in the stack follows the order in which the programs are keyed in, irrespective of the program number;

2) When steps are added/deleted, the program sequence remains unaltered - only the relative spacing of the programs changes.

Thus, the stack sequence is determined by the order in which the P keys are pressed.

Jump commands loop control

A key factor in the usefulness of a computer is its ability to test for a given condition and then, on the basis of the result, carry out alternative procedures. The GOTO/LBL type commands therefore form the backbone of a program by defining its logical flow structure.

The GOTO/LBL commands serve two purposes:

1) To enable alternative procedures pending the result of a test condition (conditional jump);

2) To enable a sequence of steps to be repeated (loop control).

Recognising the fact that loop control jumps are executed more frequently than conditional jumps, the Casio is designed so that GOTO initiates a backward search through the program. Should this fail, a forward search then begins from the GOTO command. The search is restricted to the program in which the GOTO statement occurs; if P0 has GOTO 1 at step 20 and LBL 1 at step 40, then the search will be:

1) Steps 19 to 0 then; 2) Steps 21 to 40.

A useful corollary to the above 'search rule' follows. Contrary to the Casio manual, which suggests that labels must be uniquely defined within a program, a label may be used more than once, the only proviso being that the 'search rule' results in the logic flow desired by the programmer. See Figure 1.

ADVANCED COMPUTER EQUIPMENT (LEEDS) LTD

95, MEADOW LANE, LEEDS, 11. Tel. 0532 446960

LEEDS COMPUTER CENTRE

PRICES SHATTERED

COMMODORE PET 12 months warranty

32K Professional keyboard green screen	£575
Dual disk drive 347k	£625
Cassette deck C2N	£ 50
Printer 3022 Matrix Tractor	£375

APPLE II PLUS 12 months warranty

48K Auto start	£695
Disk with controller	£383
Disk without controller	£295
Hitachi 9" monitor B/W	£120

SHARP Z80 12 months warranty

48K with 34K user RAM	£475
36K with 22K user RAM	£450
20K with 6K user RAM	£410
Disk drives, printers etc.	

SUPERBRAIN

64K with single density 320K disk	£1650
64K with double density 700K disk	£2150
Operating system * MBASIC * COBOL * FORTRAN	

PRINTERS

BD80P — Hi-speed bi-directional with adjustable tractor feed 750 byte buffer. Fantastic offer £425
IEEE * Parallel or RS232
RICOH RP1600 Daisy wheel printer £1150

SUNDRIES

Data tapes super quality (10)	£4.78
5¼" certified verbatim (10)	£27.00
Plain listing paper 2000 units	£12.50
Books * Games * Programs * galore	
Visicalc * Desktop planner special offer (P+P £1)	

Please add VAT to all goods except books — cash & carry or 24-hour delivery — your choice.

All equipment is factory fresh and fully tested in our own workshops

Standard conditions of sale applies to all products.

CALCULATOR CORNER

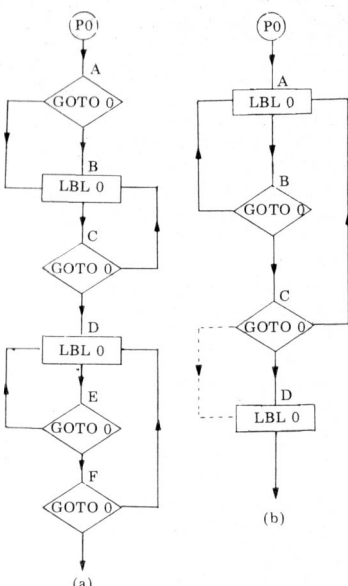


Fig 1. Multiple use of GOTO/LBL combinations. In Fig 1(a) execution will follow routes A-B, C-B, E-D and F-D. In Fig 1(b) the route C-D is invalid. NB, for convenience, the logical jump tests are not shown.

We deduce three programming rules:
1) The number of steps within a loop should be kept to a minimum, both to eliminate unnecessary repetition of steps and to reduce search time;

- Labels may be used repeatedly as long as the logic is right.
- Forward jumps should be avoided if at all possible.

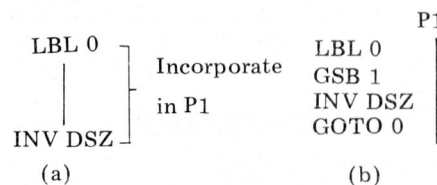


Fig 2. Use of subroutines to reduce loop read time. Replace (a) by the combination (b) with P1 placed near the beginning of the program stack.

Programming for speed

One method of reducing loop search time is to incorporate some or all of the contents of the loop in a subroutine. Figure 2 illustrates this and the table in Figure 4 shows that we may trade off GSB search steps against GOTO search steps in the ratio 10:9. So, in Figure 2(a), if the loop comprises 45 steps then a saving in read time will be made if the beginning of P1 can be located within the first 50 steps of the program stack. This analysis is rather crude in that it ignores the effect of P1 on the read time associated with lower priority programs and the resultant reduction in read time of other loops/jumps in the main program.

The problem of forward jumps is more difficult. Speeding up may result

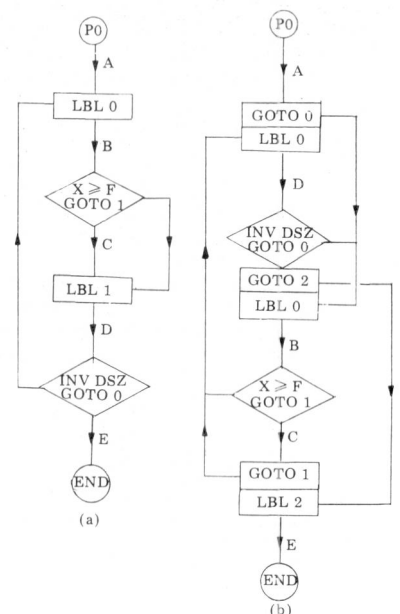


Fig 3. Reverse sequence programming. (a) Normal logic flow path; (b) Programmed in reverse sequence.

from a combination of forward and backward sequence programming. Figure 3(a) shows a logic structure forward programmed. Figure 3(b) shows the same sequence programmed in reverse. If we assume the GOTO 0/LBL 0 loop is to be repeated a large number of times and that the probability of $x \geq f$ in the GOTO 1/LBL 1 is p , then

GOTO page 158



**TODAY'S BEST
PRICE/PERFORMANCE
RATIO FROM
A MICRO
COMPUTER**

£1695

Standard Model 64K RAM/320 DISK

ALTERNATIVE MODELS
'QD' 700K DISK £1995
'S' 800K DISK plus
Function Keys etc £2095

SUPERBRAIN PACKAGES

The efficient business
system consists of
standard Superbrain
Microline 80 Printer

£2045

Complete word
processing system –
including 'Word Star'
and 'Mailmerge',
standard Superbrain,
Diablo 630 printer
and training

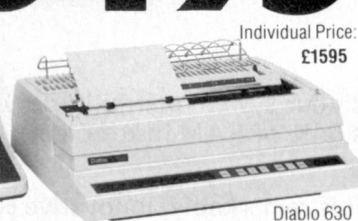
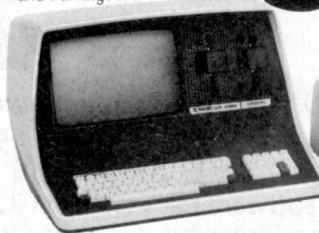
£3495



Individual Price: £395 (inc. serial interface)



Microline 80



Diablo 630

Individual Price:
£1595

Software Options: we market a full supporting
range of standard languages, including, BASIC
@ £175, FORTRAN @ £225, PASCAL @ £225,
and CIS COBOL @ £425. We have a growing
and comprehensive library of software
programmes available:

**Incomplete Records for Practising
Accountants @ £750**

Graphics – Hardware @ £435 with Software
from £80

Integrated Accounting System – Stock Control
@ £350, Order Entry and Invoicing @ £350,
Sales Ledger @ £450, Purchase Ledger @
£450, General/Nominal @ £400, Name &
Address @ £250, Complete Package so far
@ £1650 plus Payroll @ £500.

Financial Modelling – T/Maker @ £155 and
Micromodeller @ £645.

Data Base Management – DMS @ £400
Word Processing – Wordstar @ £250 and
Mailmerge @ £75.

Also available – Form Creation, Debugging etc.,
Alternatively we will design and implement
software packages to suit your specific needs.

KCB
MICROS LIMITED

KGB Micros Ltd., 88 High Street, Slough, Berks SL1 1EL Tel: Slough 38581/38319

Prices exclude V.A.T and are subject to fluctuation, please phone for an up-to-the-minute quote.



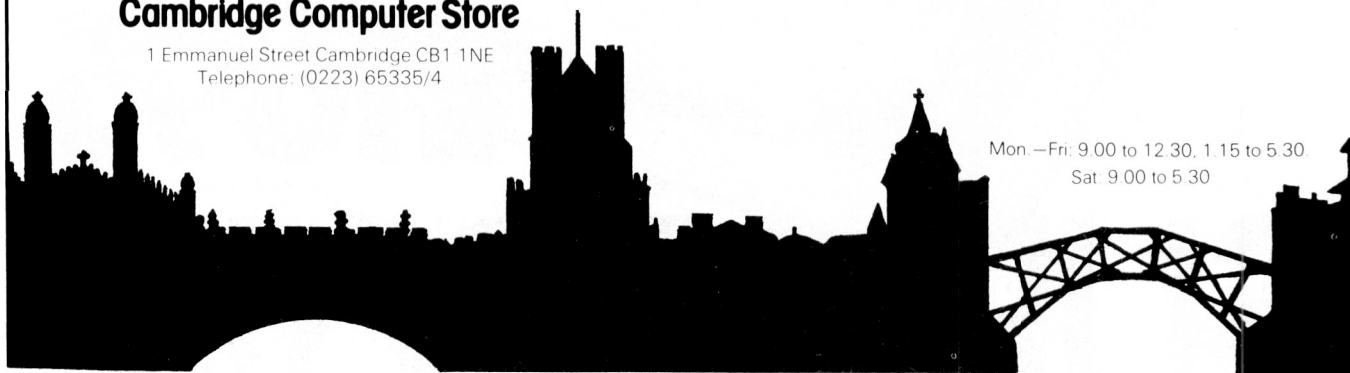
Micros have really taken off in Cambridge!

- TRS-80 Model I II & III
- Apple II & III
- North-Star Horizon
- Communicator
- Commodore Pet
- Daisy-wheel printers
- Computer books
- Acorn Atom
- Hewlett-Packard HP85
- UK101 kit computer
- Sharp pocket computer
- Wordstar/Datastar
- Plotters/digitisers
- Electronic components

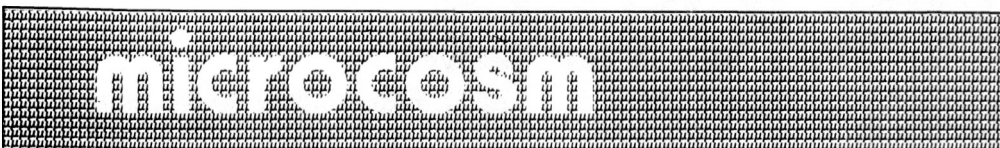
First time buyer or experienced user? See what's best in microcomputers today, all generally on demonstration and available from stock at:

Cambridge Computer Store

1 Emmanuel Street Cambridge CB1 1NE
Telephone: (0223) 65335/4



Mon.—Fri: 9.00 to 12.30, 1.15 to 5.30
Sat: 9.00 to 5.30



1, Montague Street,
London WC1B 5BP

Telephone: 01-580-9792
Telex: MTW 888941 LCCI G

DRAMATIC SPEED INCREASE for CP/M systems

Is your system painfully slow? Is it forever disk-bound? Do the alternatives look prohibitively expensive? Is 64K of RAM insufficient? At last there is a neat, cost effective solution —

THE SILICON DISK SYSTEM

This remarkable, innovative software package from J.K. Systems Research Ltd., with the addition of standard RAM, enables your microcomputer to challenge the performance of many minicomputers. Furthermore, this can usually be done without making any changes to your existing application software. THE SILICON DISK SYSTEM will run on most CP/M and MP/M systems. It allows additional RAM to be controlled in such a manner as to appear as a super-fast additional disk drive. This memory is organised using the standard CP/M file structure and therefore can be accessed by program like any other disk drive. This form of memory management gives rise directly to:

- (i) **Extended Memory Addressing Capability — up to 8 megabytes of RAM!**
- (ii) **Very fast file accessing — typically 500 times as fast as floppy disks!**

Sorting and searching long index files, lengthy compilations, database accessing and many other of those disk-bound activities which take too long on floppy or even hard disk systems can now be carried out at processor speed. Users of MP/M or CP/NET will find the benefits especially attractive.

ALL THIS FOR ONLY £295 + VAT.

Too good to be true?

Seeing is believing.

Ask your dealer to demonstrate it or contact Microcosm direct.

Dealer enquiries also welcome.

Microcosm specialises in quality CP/M system software products including ICL and IBM communications packages. Ring Peter Cheesewright for further details.

NEW

NEWCOMERS-START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, *PCW* will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, *processing* it, storing the results or sending them somewhere else. All this information is called *data* and it comprises numbers, letters and special symbols which can be read by humans. Although the data are (yes, it's plural) accepted and output by the computer in 'human' form, inside it's a different story — they must be held in the form of an electronic code. This code is called *binary* — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or *bits* as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being *ASCII* (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a *byte* and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called *hex*. The hex equivalent of a byte is obtained by giving each half a single character code (0–9, A–F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101, E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by

comparing them with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in *memory* as bytes. The rules are called *programs* and while they can be input in binary or hex (*machine code* programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the *programming language* is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is *Basic*. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an *interpreter* which picks up each English-type instruction, translates it into machine code and then feeds it into the *processor* for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with *Basic* are *PEEK* and *POKE*. They give the programmer access to the memory of the machine. It's possible to read (*PEEK*) the contents of a byte in the computer and to modify a byte (*POKE*).

Moving on to *hardware*, this means the physical components of a computer system as opposed to *software* — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit (*CPU*), a single microprocessor chip with supporting devices such as *buffers*, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board (*PCB*) or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a *bus system* is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the *SI00*.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of

memory, *RAM* (Random Access Memory) and *ROM* (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — *static* and *dynamic*; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called *PROMs* (Programmable ROMs) and *EPROMs* (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, *cassettes* and *floppy disks* are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, floppy disks are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a *read/write head* across the disk's surface. The disk is divided into concentric rings called *tracks*, each of which is in turn subdivided into *sectors*. Using a program called a *disk operating system*, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: *soft sectoring* where special signals are recorded on the surface and

hard sectoring where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the *stringy floppy* — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. *Hard disk* systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit (*VDU*), which looks like a TV screen with a typewriter-style *keyboard*; sometimes these are built into the system, sometimes they're separate. If you want a written record (*hard copy*) of the computer's output, you'll need a *printer*.

The computer can send out and receive information in two forms — *parallel* and *serial*. Parallel input/output (*I/O*) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the *baud rate* and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is *RS232* (or *V24*) while, for parallel interfaces to printers, the *Centronics* standard is popular.

Finally, a *modem* connects a computer, via a serial interface, to the telephone system allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an *acoustic coupler*, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: Packages, PCW, 14 Rathbone Place, London W1P 1DE.

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.

All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT/Petsoft	021-454 5348
A2	Arden Data Processing	0533 22255
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	01-636 1392
B3	Benchmark Computer Systems	0726 61000
B4	Bristol Software Factory	0272 23430
C1	CAP-CP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	01-499 6987
C5	Computastore Ltd.	01-499 6987
C6	Computech	01-794 0202
D1	Data Bank	0509 217671
G1	Graffcom Systems Ltd.	01-734 8862
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
H1	A. J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922

Code	Company	Telephone
H4	Hipposoft	0332 23127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	0276 62506
K1	Katanna Management Services	0245 76127
K2	Keen Computers	0602 583254
L1	Lifeboat Associates	01-836 4663
L2	Liveport (Exidy Sorcerer Firmware)	0736 798157
L3	Ludhouse (Computing) Ltd.	01-679 4321
M1	Micro Computer Applications Ltd.	0734 470425
P1	Padmede Computer Services	025671 2434
P2	Personal Computers Ltd.	01-626 8121
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 23570
S4	Systematics International	0268 284601
S5	Sumlock Bondain	01-250 0505
T1	Tridata Micros Ltd.	021 622 1754
V1	Vlasak Electronics Ltd.	062-84 74789

Applications

Application	Machine	Price	Code
Appointments planner	Commodore/Computhink	£100	S3
Assembler dev	PET/CPM	£50	L2
Bank accounts	Apple II Commodore/Computhink ITT 2020 PET	£10 £100 £10 £10	D1 S3 D1 D1
Bonds/pension quotations	Commodore/Computhink	£100	S3
Budgeting package	MCZ Zilog	£500 +	I1
Bureau de change	CBM	£8	H3
Cash flow	Apple II Apple II CP/M PET	£75 £80 £250 £8	P2 V1 L3 A1
Cash register	Apple II ITT 2020 PET	£10 £10 £10	D1 D1 D1
CBasic	Tandy Model II	£70	M1
Company secretary	CP/M	£450	C4
Conference organiser	MCZ Zilog	£500 +	I1
Contract costing	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II PET	£98 £650	P2 B4
Database management/Information retrieval	ACT800 Apple Apple Apple Apple Apple II Apple II/ITT 2020 Commodore/Computhink CP/M CP/M CP/M Cromemco North Star Horizon PET PET PET PET/CPM PET/CPM PET/CPM PET/CPM Tandy Model I TRS-80 TRS-80 TRS-80 8000 Series	£225 £150 £150 £60-140 £150 £98 £100 £45-250 £150-750 £100 £250 £250 £170 £325 £225 £75 £50/150 £150 £150 £25-80 £60 £150 £32.50 POR	H4 A2 K2 S2 S5 P2 S4 S3 C4 G3 B3 B3 C3 A1 H4 B1 C2 J1 G2 M1 S2 J1 H1 C2
Disk operating system	PET/CPM	£150	B1
Estate agent	Apple Apple Apple Apple II Apple II/ITT 2020 CBM Commodore/Computhink CP/M PCC 2000 Simpelec Triton 3 PET	£850 £850 £850 £175 £750 £30 £250 £750 £350 £25 £25	A2 S5 K2 P2 S4 H3 S3 C4 B3 A1
Equipment lease/rent/HP	CP/M	£400	G1

Application	Machine	Price	Code
Financial modelling	CP/M	£400	G1
Financial planning	Apple II/ITT 2020	£250	S4
General ledger/NL	Apple Apple Apple Apple II Apple II Apple II CBM Commodore/Computhink CP/M CP/M CP/M CP/M CP/M Cromemco ITT 2020 ITT 2020/Apple II North Star Horizon PCC 2000 Simpelec Triton 3 PET/CPM Tandy Model I Tandy Model II TRS-80 TRS-80 I TRS-80 I TRS-80 II TRS-80 II Vector 8080/Z80 8080/Z80	£300 £300 £300 £295 £225 £295 £200 POR £500 £500 £375 £500 £400 £250 £295 £250P £250 £250 £350 £200 £90 £90 £225 £225/325 £325 £425 £425 £400 £357 £275	A2 S5 K2 P2 V1 C6 H3 S3 L3 K1 L1 C4 G1 B3 C6 S4 B3 B2 C2 M1 M1 H1 T1 K1 T1 C5 L1 G3
Hire purchase	Cromemco	£400 +	B3
Incomplete records	Apple Apple Apple II Commodore/Computhink Tandy Model I TRS-80	£250 POR £125 £750 £40 £40	S2 K2 P2 S3 M1 H1
Individual designed programs	TRS-80 I	£100 +	K1
Integrated Accts	Altos (CP/M, MP/M) Apple II Apple II Apple II Apple II Commodore/Computhink CP/M CP/M CP/M CP/M Cromemco ITT 2020 MZ-80K North Star Horizon PET/CPM PET/CPM PET/CPM PET/CPM Tandy Model I Tandy Model II TRS-80 Vector 8000 Series 8080/Z80 8080/Z80	£300 £450 £340 £855 POR £950 £1500 £1100 £950 £450 £150 £950 £950 £350 £300 £300 £650 £650 £350 £350 £75 £1000 POR £950 £995	B1 P1 P2 V1 S3 L1 C4 G1 B3 P1 P2 B3 B3 B1 C2 J1 G2 M1 M1 J1 C5 C2 L1 G3
Investment portfolio	TRS-80	£20	S2
Invoicing	Apple Apple II Apple II Apple II Commodore/Computhink CP/M	£295 £300 £125 £140 POR £500	S2 P1 P2 V1 S3 K1

Application	Machine	Price	Code
	CP/M CP/M Cromemco North Star Horizon PET PET/CPM PET/CPM PET/CPM Tandy Model I Tandy Model II TRS-80 TRS-80 TRS-80 TRS-80 8080/Z80 ITT 2020	£325 £150-350 £100 £100 £350 £25-50 POR £90 £90 £25 £75 £75 £125 £325 £300	L1 C4 B3 B3 A1 B1 J1 M1 M1 H1 T1 K1 T1 L1 P1
Job costing	Apple II Apple II CP/M ITT 2020 Tandy Model I Tandy Model II	£125 £300 £700 £300 POR POR	P2 P1 C4 P1 M1 M1
Job order control	8080/Z80	£275	G3
Leasing	Cromemco	£400 +	B3
Legal precedents	CP/M	£1100	C4
Letter writer	Apple II	£80	V1
Lisp	PET/CPM	£75	C2
Lotteries	PET	£45	H2
Mailing list	Altos (CP/M, MP/M) Apple Apple Apple Apple Apple II Apple II Apple II/ITT 2020 CBM Commodore/Computhink CP/M CP/M ITT 2020 PET PET PET PET/CPM PET/8032 Tandy Model I Tandy Model II TRS-80 TRS-80	£75 £300 £50-150 £300 £300 £40 £50 £45 £50 £15 £75 £75/150 £40 £75 £50-150 £25/38/55	B1 A2 S2 S5 K2 P2 D1 H2 D1 A1 B1 S1 B1 M1 M1 S2 H1
Mail shot	Apple Apple II Commodore/Computhink CP/M MCZ Zilog PCC 2000 Simpelec Triton 3 Tandy Model II	£14 £225 £125 £200-360 £250 £450 £450 £75	S2 P2 S3 C4 I1 B2 M1
Membership acting	PET	£85	H2
Order entry/invoicing	CP/M	£350	G1
Order processing	CP/M 8080/Z80	£550 £550	L1 L1
Office admin	Apple II/ITT 2020	£100	S4
Pad to plotter systems	Apple II	£250	P2
Pascal	PET/CPM	£120	C2
Payroll	Apple Apple Apple Apple Apple II Apple II Apple II Apple II Apple II Apple II Apple II/ITT 2022 CBM CP/M CP/M CP/M CP/M Cromemco ITT 2020 ITT 2020 North Star Horizon PET PET PET PET PET/CPM PET/CPM PET/CPM PET/CPM Sorcerer Tandy Model I TRS-80 TRS-80 TRS-80 TRS-80 8000 Series 8080/Z80 8080/Z80	POR £200 £200 £200 £200 £375 £375 £10 £10 £10 £250P £10 £450 £500 £475 £495 £500 £350 £375 £10 £350 £200/350 £195 £50/195 £10 £150 £150 £150 £150 £250 £249 £200 £200 £218 £218 £375 £250 £475 £275	A2 S2 S2 S5 K2 P2 V1 C6 D1 S4 H3 L3 K1 L1 C4 B3 C6 D1 B3 C5 A1 I2 D1 G2 J1 C2 L2 M1 H1 K1 T1 T1 C2 L1 G3
Personnel records	Apple II CP/M MCZ Zilog PET	£98 £450 £500 + £85	P2 C4 I1 H2

**DIRECT
ACCESS**

Application	Machine	Price	Code
Petaid report generator	Commodore/Computhink	£125	S3
Petsoft programs	PET/CBM	£160	J1
Planning/Maintenance	PET/8032	£595	S1
Postal advertising response package	Apple	£350	S2
PR/advertising package	Commodore/Computhink	£1000	S3
Price lister	CBM	£12	H3
Printers job control	Commodore/Computhink	£250	S3
Production analysis	Apple II CP/M PET/CBM	£75 £700 £300	P2 C4 B1
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£450-1000	C4
Purchase ledger	Apple Apple Apple Apple II Apple II Apple II Apple II Apple II/ITT 2020 CBM Commodore/Computhink CP/M CP/M CP/M CP/M CP/M Cromemco ITT 2020 ITT 2020 North Star Horizon PCC 2000 Simpelec Triton 3 PET PET 350 PET/CBM PET/CBM PET/8032 Tandy Model I Tandy Model II TRS-80 TRS-80I TRS-80I TRS-80I1 Vector 8000 Series 8080/Z80 8080/Z80	£300 £300 £300 £295 £300 £295 £315 £250P £350 POR £500 £450 £450 £500 £500 £425 £250 £295 £300 £250 £350 £350 £300 £300 £800 £95/120/ £350 POR £395 £90 £90 £225 £225 £225 £225 £400 £250 £275 £425	A2 S5 K2 C6 P2 P1 V1 S4 H3 S3 C4 G1 L3 K1 L1 B3 C6 P1 B3 B2 B4 A1 C2 J1 S1 M1 H1 T1 K1 T1 C5 C2 G3 L1
Revolving credit	Cromemco	£400 +	B3
Sales ledger	Apple Apple Apple Apple II Apple II Apple II Apple II Apple II/ITT 2020 CBM Commodore/Computhink CP/M CP/M CP/M CP/M CP/M Cromemco ITT 2020 ITT 2020 North Star Horizon PCC 2000 Simpelec Triton 3 PET PET PET PET/CBM PET/CBM PET/8032 Tandy Model I Tandy Model II TRS-80 TRS-80I TRS-80I TRS-80I1 Vector 8000 Series 8080/Z80 8080/Z80	£300 £300 £300 £295 £300 £295 £315 £250P £350 POR £500 £450 £500 £500 £425 £250 £295 £300 £250 £350 £350 £300 £300 £800 £95/350 P1 P2 C2 £395 £90 £90 £225 £225 £225 £225 £375 £400 £250 £275 £425	A2 S5 K2 C6 P1 P2 V1 S4 H3 S3 C4 G1 L3 K1 L1 B3 C6 P1 B3 B2 B4 C1 A1 J1 C2 S1 M1 M1 H1 T1 K1 T1 C5 C2 G3 L1
Salesman	Apple II ITT 2020 PET	£10 £10 £10	D1 D1 D1
Screen generator	MCZ Zilog	£75 +	I1
S/L, P/L & stock control	CP/M	£1000	L3
Solicitor's complete record accounting	Apple	£3000	S2
Solicitor's package	PET/8032	£750	S1

Application	Machine	Price	Code	
Statistics	Apple	£150	G3	
	Apple II	£100-195	P2	
	TRS-80	£45	S2	
Stock control/ recording	Altos (CP/M, MP/M)		B1	
	Apple	£300	A2	
	Apple	POR	K2	
	Apple	POR	S5	
	Apple	£150	G3	
	Apple	£80	S2	
	Apple II	£35/98	P2	
	Apple II	£10	D1	
	Apple II	£285	V1	
	Apple II	£300	P1	
	Apple II/ITT 2020	£500	S4	
	CBM	£35/25	H3	
	Commodore/ Computhink	£100/250	S3	
	CP/M	£500	K1	
	CP/M	£325	L1	
	CP/M	£500-1500	C4	
	CP/M	£350	G1	
	Cromemco	£450	B3	
	ITT 2020	£10	D1	
	ITT 2020	£300	P1	
	MZ-80K	£150	P2	
	North Star			
	Horizon	£450	B3	
	PCC 2000			
	Simpelec Triton 3	£350	B2	
	PET	£12/25/ 350	A1	
	PET	£10	D1	
	PET	£195	I2	
	PET	£300	B4	
	PET	£15	A2	
	PET/CBM	£300	B1	
	PET/CBM	£150	C2	
	PET/CBM	£150	J1	
	PET/CBM	£150	G2	
	PET/Computhink	£250	R1	
	PET/8032	£395	S1	
	Tandy Model I	£30-50	M1	
	Tandy Model II	£300	M1	
	TRS-80	£48	S2	
	TRS-80	£200	H1	
	TRS-80	£115	J1	
	TRS-80I	£200	K1	
	TRS-80I	£200	T1	
	TRS-80II	£375	T1	
	8080/Z80	£275	G3	
	8080/Z80	£325	L1	
	TAP business system	PET	£125	H2
	Text file librarian	Apple II/ITT 2020	£125	S4
	Time/cost recording	Apple	£450	S2
		Apple II	£300	P1
Apple II		£125	P2	
Commodore/ Computhink		POR	S3	
CP/M		£400	G1	
Cromemco		£250	B3	
ITT 2020		£300	P1	
North Star				
Horizon		£250	B3	
PCC 2000				
Simpelec Triton 3		£350	B2	
PET/CBM		£300	B1	
Tandy Model I		POR	M1	
Tandy Model II		POR	M1	
Utilities		Apple II	£20	C6
	ITT 2020	£20	C6	
Utility set	CBM	£78	H3	
VAT	PET	£17.50	A1	
VAT master	CBM	£25	H3	
VAT register	TRS-80	£15	H1	
Vet package	PET/8032	POR	S1	
Video message	Apple	£200	G3	
Warehousing	PET/8032	POR	S1	
Word processing	ACT 800	£375	H4	
	Apple	£60	S2	
	Apple	£75	K2	
	Apple	£75	S5	
	Apple	£75	A2	
	Apple II	£150-300	P2	
	Apple II	£75	J1	
	Apple II	£120	V1	
	Apple II	£40	D1	
	Apple II/ITT 2020	£180/95	S4	
	CBM	£35	H3	
	Commodore/ Computhink	£120	S3	
	CP/M	£500	K1	
	CP/M	£150-260	C4	
	CP/M	£400	G1	
	ITT 2020	£40	D1	
	MCZ Zilog	£500 + £85/65/ 40/20	I1	
	PET	£40	H2	
	PET	£375	D1	
	PET	£25/325	A1	
	PET	£325	C5	
	PET/CBM	£75/150	C2	
	PET/CBM	£75/150	J1	
	PET/CBM	£75/150	G2	
	Tandy Model I	£50/75	M1	
	Tandy Model II	£175-240	M1	
	TRS-80	£30/60/90	S2	
	TRS-80	£45/95	J1	
	TRS-80	£15	H1	
	TRS-80I	£70	K1	
	Vector	£400	C5	
	8000 Series	£250	C5	

Machines

Machine	Application	Price	Code
ACT 800	Database management/	£225	H4
	Word processing	£375	H4
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple	Database management/		
	information retrieval	£150	K2
	Database management/		
	information retrieval	£150	A2
	Database management/		
	information retrieval	£60-140	S2
	Database management/		
	information retrieval	£150	S5
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	General ledger/NL	£300	K2
	General ledger/NL	£300	A2
	General ledger/NL	£300	S5
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Invoicing	£295	S2
	Job costing	£450	S2
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mail shot	£14	S2
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Postal advertising		
	response package	£350	S2
	Purchase ledger	£300	K2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Solicitor's complete		
	record accounting	£3000	S2
	Statistics	£150	G3
	Stock control/recording	£150	G3
	Stock control/recording	POR	K2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Time/cost recording	£450	S2
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£75	S5
Apple II	Bank account	£10	D1
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash register	£10	D1
	Credit control	£98	P2
	Database management/		
	information retrieval	£98	P2
	Estate agent	£175	P2
	General ledger/NL	£225	V1
	General ledger/NL	£295	P2
	General ledger/NL	£295	C6
	Incomplete records	£125	P2
	Integrated accts	£855	V1
	Integrated accts	£450	P1
	Integrated accts	£340	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£125	P2
	Job costing	£125	P2
	Job costing	£300	P1
	Letter writer	£80	V1
	Mailing list	£40	D1
	Mailing list	£40	P2
	Mail shot	£225	P2
	Pad to plotter system	£250	P2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£10	D1
	Personnel records	£98	P2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£295	P2
	Purchase ledger	£295	C6
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£295	P2
	Sales ledger	£295	C6
	Salesman	£10	D1
	Statistics	£100-195	P2
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£35/98	P2
	Stock control/recording	£10	D1
	Time/cost recording	£300	P1
	Time/cost recording	£125	P2
	Utilities	£20	C6
Word processing	£120	V1	
Word processing	£150-300	P2	
Word processing	£40	D1	
Word processing	£75	J1	
Apple II/ITT 2020	Database management/		
	information retrieval	£100	S4
	Estate agent	£750	S4
	Financial planning	£250	S4
	General ledger/NL	£250P	S4
	Mailing list	£100	S4
	Office admin	£100	S4
Payroll	£250P		
Purchase ledger	£250P	S4	



L&J COMPUTERS

192 HONEYPOT LANE, QUEENSBURY, MIDDX HA7 1EE
THE "PET" SPECIALISTS



NOTE OUR NEW ADDRESS ▷ ▷ ▷ ▷ ▷ THIS IS WHERE IT IS!

ALTHOUGH WE HAVE MOVED
TO LARGER PREMISES,
WE ARE STILL GIVING
THE SAME PERSONAL SERVICE
THAT WAS OUR HALLMARK
AT KINGSBURY.



THIS INCLUDES FINDING OUT
WHAT YOU NEED BEFORE YOU BUY,
SO THAT YOU ARE ASSURED THAT
THE EQUIPMENT & SOFTWARE YOU PURCHASE FROM US FITS YOUR REQUIREMENTS!

AFFORDABLE CBM 'PET' PRICES!!

Available from stock:

4008 (8K)	£420*
4016 (16K)	£499*
4032 (32K)	£630*
8032 (32K SUPERPETS)	P.O.A.
EXT CASSETTE DECKS (inc. Counter)	£55

**TRY US!
YOU WILL NOT BE
DISAPPOINTED**

Printers
CBM 4022
CENTRONIC 779
CENTRONIC 737
SPINWRITER 5510

Disk Drives
CBM 8050
CBM 4040
CBM 3040
COMPU/K 800K

Sundries
INTERFACES: C12 CASSETTES
DISKS: LIBRARY CASES
PAPER (ROLL & TRACTOR FEED)
LABELS: DUST COVERS

**TOOL KITS (BASIC 2 & 4), SUPERCHIPS
... AND ALL SORTS OF OTHER CHIPS...
UPGRADE YOUR PET EVEN MORE!!**

**The 'MUPETS' are HERE!
3 to 8 PETs only need 1 DISK DRIVE
Daily demonstrations: Ring for details.**



**COMPLETE SYSTEMS
FROM £1700!!**

**THE ESTIMATES WE SUPPLY & INSTALL ARE COMPLETE
ESTIMATES GIVEN FREE WITH NO HIDDEN EXTRAS:
FULL BACK-UP: GUARANTEED EXPERTISE.**

✶ PRICES DO NOT INCLUDE VAT

SOFTWARE

As well as a full range of Petsoft and Commodore Software, we have some highly reliable "Home-Brewed" programs available.

STOCK CONTROL & INVOICING £60
(Handles up to 500 items — 32k) (80 on 16K). Stock depleted on invoicing, search etc. Cassette, disk (& colour print option).

CASH BOOK £90
Enter daily/weekly amounts — printout and totals, weekly monthly analysis, totals and balances.
(4032, & 8032 Versions £110 & £120).

STOCK TAKING Cuts out all the hard work £230
OUTSIDE SERVICES (For Mini-Cabs etc.) £220

Sae for free software booklet

Specialists in: Commodore Business Programs
Bristol Trader, Item & Monitor
Superpay, Word Processing.

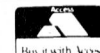
**SPECIALISED SOFTWARE APPLICATIONS
UNDERTAKEN. RING FOR DETAILS**

2 FOR JUST OVER THE PRICE OF 1!

We now have limited stock of new cassette decks with a built-in counter soundbox for PETs!
At ONLY £65*
Orders dealt with in strict rotation.

**PERSONAL SHOPPERS WELCOME
Phone & Mail Orders accepted.**

**ALL GOODS SENT SAME DAY WHEREVER POSSIBLE
LARGE S.A.E. FOR LISTS ETC.**



PACKAGES

**DIRECT
ACCESS**

Machine	Application	Price	Code	Machine	Application	Price	Code	Machine	Application	Price	Code
	Sales ledger	£250P	S4		Salesman	£10	D1	PET/ Computhink	Stock control/recording	£250	R1
	Stock control/recording	£500	S4		Stock control/recording	£10	D1				
	Text file librarian	£125	S4		Stock control/recording	£300	P1				
	Word processing	£180/95	S4		Time/cost recording	£300	P1		PET/8032	Mailing list	£75/150
CBM	Bureau de change	£8	H3	MCZ Zilog	Utilities	£20	C6		Planning maintenance	£595	S1
	Estate agent	£30	H3		Word processing	£40	D1		Purchase ledger	£395	S1
	General ledger/NL	£200	H3		Budgeting package	£500 +	I1		Sales ledger	£395	S1
	Mailing list	£35	H3		Conference organiser	£500 +	I1		Solicitor's package	£750	S1
	Payroll	£10	H3		Mail shot	£200	I1		Stock control/recording	£395	S1
	Price lister	£12	H3		Personnel records	£500 +	I1		Vet package	POR	S1
	Purchase ledger	£350	H3		Screen generator	£75 +	I1		Warehousing	POR	S1
	Sales ledger	£350	H3		Word processing	£500 +	I1	Sorcerer	Payroll	£250	L2
	Stock control/recording	£35/25	H3	MZ-80K	Integrated accounts	£150	P2				
	Utility set	£78	H3		Stock control/recording	£150	P2				
	VAT master	£25	H3	North Star Horizon	Database management/ information retrieval	£250	B3	Tandy Model I	Database management/ information retrieval	£25-80	M1
	Word processing	£35	H3		General ledger/NL	£250	B3		General ledger/NL	£90	M1
Commodore/ Computhink	Appointments planner	£100	S3		Integrated accts	£950	B3		Incomplete records	£40	M1
	Bank accounts	£100	S3		Invoicing	£100	B3		Integrated accts	£350	M1
	Bonds/pension quotations	£100	S3		Payroll	£350	B3		Invoicing	£90	M1
	Database management/ information retrieval	£45-250	S3	Purchase ledger	£250	B3	Job costing		POR	M1	
	Estate agent	£250	S3	Sales ledger	£250	B3	Mailing list		£40	M1	
	General ledger/NL	POR	S3	Stock control/recording	£450	B3	Payroll		£249	M1	
	Incomplete records	£750	S3	Time/cost recording	£250	B3	Purchase ledger		£90	M1	
	Integrated accts	POR	S3	PCC 2000 Simpelec Triton 3	Estate Agent	£350	B2		Sales ledger	£90	M1
	Invoicing	POR	S3		General ledger/NL	£350	B2		Stock control/recording	£30-50	M1
	Mailing list	£100	S3		Mail shot	£450	B2		Time/cost recording	POR	M1
	Mail shot	£125	S3		Purchase ledger	£350	B2		Word processing	£50/75	M1
	Petaid report generator	£125	S3		Sales ledger	£350	B2	Tandy Model II	CBasic	£70	M1
	PR/advertising package	£1000	S3		Stock control/recording	£350	B2		CP/M + utilities	£150	M1
Printers job control	£250	S3	Time/cost recording		£350	B2	General ledger/NL		£90	M1	
Purchase ledger	POR	S3	PET	Bank account	£10	D1	Integrated accts		£350	M1	
Sales ledger	POR	S3		Cash flow	£8	A1	Invoicing		£90	M1	
Stock control/recording	£100/250	S3		Cash register	£10	D1	Job costing		POR	M1	
Time/cost recording	POR	S3		Credit control	£650	B4	Mailing list		£75	M1	
Word processing	£120	S3		Database management/ information retrieval	POR	C1	Mail shot		£75	M1	
CP/M	Cash flow	£250		L3	Database management/ information retrieval	£325	A1		Purchase ledger	£90	M1
	Company secretary	£450		C4	Database management/ information retrieval	£225	H4		Sales ledger	£90	M1
	Contract costing	£2000		L3	Database management/ information retrieval	£170	C3	Stock control/recording	£300	M1	
	Database management/ information retrieval	£150-750		C4	Estate agent	£25	A1	Time/cost recording	POR	M1	
	Database management/ information retrieval	£100		G3	General ledger/NL	£1000	C1	Word processing	£175-240	M1	
	Equipment lease/rent/ HP	£400		G1	Invoicing	£350	A1	TRS-80	Database management/ information retrieval	£60	S2
	Estate agents	£750		C4	Invoicing	£400	C1		Database management/ information retrieval	£32.50	H1
	Financial modelling	£400	G1	Lotteries	£45	H2	Database management/ information retrieval		£150	J1	
	General ledger/NL	£500	L3	Mailing list	£15	A1	General ledger/NL		£225	H1	
	General ledger/NL	£500	C4	Mailing list	£50	D1	Incomplete records		£40	H1	
	General ledger/NL	£400	G1	Mailing list	£45	H2	Integrated accts	£75	J1		
	General ledger/NL	£500	K1	Membership accting	£85	H2	Investment portfolio	£20	S2		
General ledger/NL	£375	L1	Payroll	£50/195	I2	Invoicing	£25	H1			
Integrated accts	£1500	C4	Payroll	£10	D1	Mailing list	£25/38/	H1			
Integrated accts	£1100	G1	Payroll	£50/25/	I2		£5				
Integrated accts	£950	L1	Payroll	195	A1	Mailing list	£50-150	S2			
Invoicing	£325	L1	Payroll	£200/350	C5	Payroll	£200	H1			
Invoicing	£150-350	C4	Personnel records	£85	H2	Purchase ledger	£225	H1			
Invoicing	£500	K1	Purchase ledger	£95/120/	A1	Sales ledger	£225	H1			
Job costing	£700	C4		350	A1	Statistics	£45	S2			
Legal precedents	£1100	C4	Purchase ledger	£1000	C1	Stock control/recording	£200	H1			
Mailing list	£50-150	C4	Purchase ledger	£300	B4	Stock control/recording	£48	S2			
Mailing list	£250	G1	Sales ledger	£300	B4	Stock control/recording	£115	J1			
Mail shot	£200-360	G4	Sales ledger	£800	C1	VAT register	£15	H1			
Order entry/invoicing	£350	G1	Sales ledger	£95/350	A1	Word processing	£45/95	J1			
Order processing	£550	L1	Salesman	£10	D1	Word processing	£15	H1			
Payroll	£450	L3	Stock control/recording	£195	I2	Word processing	£30/60/	S2			
Payroll	£495	C4	Stock control/recording	£10	D1		90				
Payroll	£500	G1	Stock control/recording	£12/25/	A1	TRS-80I	General ledger/NL	£225/325	T1		
Payroll	£500	K1		350	A1		General ledger/NL	£325	K1		
Payroll	£475	L1	Stock control/recording	£15	A2		Individual designed programs	£100 up	K1		
Personnel records	£450	C4	Stock control/recording	£300	B4		Invoicing	£75	K1		
Production analysis	£700	C4	TAP business system	£125	H2	Invoicing	£75	T1			
Property management	£450-1000	C4	VAT	£17.50	A1	Payroll	£218	T1			
Purchase ledger	£500	L3	Word processing	£40	D1	Payroll	£218	K1			
Purchase ledger	£450	G1	Word processing	£85/65/	H2	Purchase ledger	£225	K1			
Purchase ledger	£500	K1		40/20	H2	Purchase ledger	£225	T1			
Purchase ledger	£425	L1	Word processing	£375	H4	Sales ledger	£225	T1			
Purchase ledger	£500	C4	Word processing	£25/325	A1	Sales ledger	£225	K1			
Sales ledger	£500	L3	Word processing	325	C5	Stock control/recording	£200	K1			
Sales ledger	£500	C4	PET/CBM	Assembler dev	£50	C2	Stock control/recording	£200	T1		
Sales ledger	£450	G1		Database management/ information retrieval	£75	B1	Word processing	£70	K1		
Sales ledger	£500	K1		Database management/ information retrieval	£50/150	C2	TRS-80II	General ledger/NL	£425	T1	
Sales ledger	£425	L1		Database management/ information retrieval	£150	G2		Invoicing	£125	T1	
S/L, P/L + stock control	£1000	L3		Database management/ information retrieval	£150	J1		Payroll	£375	T1	
Stock control/recording	£325	L1		Database management/ information retrieval	£150	B1		Purchase ledger	£375	T1	
Stock control/recording	£500-1500	C4		Disk operating system	£150	B1	Sales ledger	£375	T1		
Stock control/recording	£350	G1		General ledger/NL	£200	C2	Stock control/recording	£375	T1		
Stock control/recording	£500	K1		Integrated accts	£300	B1	Vector	General ledger/NL	£400	C5	
Time/cost recording	£400	G1		Integrated accts	£50	C2		Integrated accts	£1000	C5	
Word processing	£500	K1		Integrated accts	£650	G2		Purchase ledger	£400	C5	
Word processing	£400	G1		Integrated accts	£650	J1		Sales ledger	£400	C5	
Word processing	£150-260	C4	Invoicing	POR	J1	Word processing	£40	C5			
Cromemco	Database management/ information retrieval	£250	B3	Invoicing	£25-50	B1	8000 Series	Database management/ information retrieval	POR	C2	
	General ledger/NL	£250	B3	Lisp	£75	C2		Integrated accts	POR	C2	
	Hire purchase	£400 +	B3	Mailing list	£75	B1		Payroll	£250	C2	
	Integrated accts	£950	B3	Pascal	£120	C2		Purchase ledger	£250	C2	
	Invoicing	£100	B3	Payroll	£150	G2		Sales ledger	£250	C2	
	Leasing	£400 +	B3	Payroll	£150	J1		Word processing	£250	C2	
	Purchase ledger	£250	B3	Payroll	£150	C2	8080/Z80	Database management/ information retrieval	POR	C2	
	Revolving credit	£400 +	B3	Petsoft programs	£160	J1		General ledger/NL	£275	G3	
	Sales ledger	£250	B3	Production analysis	£300	B1		General ledger/NL	£375	L1	
	Stock control/recording	£450	B3	Purchase ledger	£200	C2		Integrated accts	£950	L1	
	Time/cost recording	£250	B3	Purchase ledger	POR	J1		Integrated accts	£995	G3	
				Sales ledger	POR	J1		Invoicing	£325	L1	
ITT 2020	Bank account	£10	D1	Sales ledger	£200	J1	Job order control	£257	G3		
	Cash register	£10	D1	Stock control/recording	£150	C2	Order processing	£550	L1		
	General ledger/NL	£295	C6	Stock control/recording	£300	B1	Payroll	£475	L1		
	Integrated accts	£450	P1	Stock control/recording	£150	G2	Payroll	£275	G3		
	Invoicing	£300	P1	Stock control/recording	£150	J1	Prof appts groups	£275	G3		
	Job costing	£300	P1	Time/cost recording	£300	B1	Prof appts individ	£220	G3		
	Mailing list	£50	D1	Word processing	£75/150	J1	Prof client billing	£330	G3		
	Payroll	£10	D1	Word processing	£75/150	G2	Purchase ledger	£425	L1		
	Payroll	£375	C6	Word processing	£75/150	C2	Purchase ledger	£275	G3		
	Purchase ledger	£300	P1				Sales ledger	£275	G3		
	Purchase ledger	£295	C6				Sales ledger	£425	L1		
	Sales ledger	£300	P1				Stock control/recording	£325	L1		
Sales ledger	£295	C6				Stock control/recording	£275	G3			

TRANSACTION FILE

We charge a flat fee of £1 for one insertion of up to 30 words. Ads for this section are accepted only from non-commercial readers. Please type or write clearly. Send your ad plus PO or cheque for £1, payable to SportsScene Publishers (PCW) Ltd, to: Transaction File, PCW, 14 Rathone Place, London W1P 1DE

For sale

PET 8k... old ROM, with Superchip & Toolkit, £345. Tel Jon Boon, St Ives (Cambs) (0480) 63981.

ZX80... Sinc built, PSU, leads, manual, book 'Making the most of your ZX80', as new, £75. Tel Wokingham 786194.

MK14... revised monitor, tape int, new keybrd, £40. Prof ASCII keybrd, new, £25 or exch both for ZX80. Tel Hull 443316.

ZX80... built, leads, printer interface & s/w, inv video sw, £116. A Slim, Cross Keys, Little Bealings, Suffolk, tel Ipswich 624308 after 6.

Superboard II... new, 4k RAM, 10 I/O ports, PSU, cased, new cass rec, £165 will send. M Ozbilen, 18 Houndiscombe Rd, Plymouth.

Atari carts... Skydiver, Bowling, Hunt'n'Score, Codebreakers, Air-sea Battle, Outlaw, Golf, Video Olympics, Breakout, £12.50 ea. Tel Wellington (Som) 2095.

Apple II+ 48k... 2 disk drives, mod, £200 worth progs, £1200. Integer card, £100. Romplus card, £100. Supertalker £150. Silentyte printer with int & 4 rolls paper, £300. Tel 0277 224539.

ZX80... Sinc built, PSU, manual, leads, tapes, book of 30 progs, 3m old, good cond, £85. Tel Peacehaven 3222.

PET 8k... int cass, old ROMs, green screen, tape ctr, lots of s/w worth £100, manual, set TI workbooks, £350 ono. Tel Bourne End 26576 eves.

ZX80... Sinc built, 1k RAM, extra progs, £70. Tel Reigate 42034.

Radio Shack... Quick printer 2, 2 rolls paper, upper/lower case, 3 ints switch selectable, 120 lines/min, 5x7 dot matrix, 96 char set, with keybrd cable, manual, boxed, little used, £100. Tel John, Kirkham (0772) 683504 after 6.

ZX80... Sinc built, leads, manual, £55. PSU if req, £7. Tel Horndean (0705) 592478.

PET 16k... new ROM, large keybrd, cass, progs, books, £550 ono. Tel John, 01-886 3922 eves, 01-556 3023/6040 day.

Superboard 2... 8k RAM, PSU, UHF mod, cased, offers around £200. Tel Photos, 01-889 6414 after 6.

ITT 2020... 48k, 1 yr old, tape s/w, £700 ono. Tel 0323 22546 after 6.

Acorn Atom... 4k RAM, manual, PSU, leads, Acorn built, 6 m old, £160. J Macleod, 64 Perceval Rd, Stormoway, Isle of Lewis, Scotland.

IBM Selectric 735... golfball typewriter/printer, complete with the horrid IBM multiway plug & sket, £200. Fax machines: I have 3 GSI DEX machines, £25 for the lot. Teletype ASR33, 120 V supply needed, £60. Tel: Dr Bulger, 01-985 1314.

ZX80... perfect working order, 4k RAM, PSU, manuals, leads, progs, cassettes, etc. Tel: 0734 790989 after hours.

Ohico Superboard II... case, 5 A PSU, RS232 int, UHF or direct video output, 38-way expansion conn, 8k RAM, software inc Alien, Invaders & much more, £220 ono. Tel: Tilbury 71554 after 6.30.

OSI C2... 8k RAM, new Cegmon monitor, OSI & Sams manuals, 5 utility & games tapes, £350. OSI 527 24k exp brd with 12k, £150. Mk 14 with sep calc-type kbrd/display, PSU, manual, micro information books, £55. Tel: Bristol (0272) 659278 eve.

Nascom 1... with buffer brd, 16k RAM brd, PSU, fast cass int, vid monitor, cased with sep keybrd case, Basic, Zeap, doc, £250 ono. Tel 0803 555831.

ZX80... fact built, good cond, PSU, leads, £39.95 or p/ex for 8k PET. P Osbond, 5 Quartercroft, Pyramid Close, Weston Favell, Northants, tel 07072 63411.

Atari... prog TV game, perfect cond, joysticks, paddles, instructions, carts inc Combat, Breakout, Space Invaders, £90 no offers. Tel 01-555 8054.

PET 2001... old ROM, 8k, exc cond, £350 ono. Tel Kerl, 01-831 6781 ext 281 office hrs.

Acorn System 1... exc intro to m/c programming, built with PSU, manuals, several progs, exc cond, £55 ono. Tel Alastair, 031-449 3944.

ZX80... 6 wks old, Sinc built, all leads, PSU, manual, tape with games if req, £75. Tel 01-708 1703 after 4.

ZX80... built, inc leads, books, etc, £70 ono. Tel 01-853 5860 after 6 or w/ends.

UK101... 8k Basic, 8k RAM, new monitor, perfect cond, over 70 progs, Compukit case, cass rec, £350 ono. 33 Baresdale Close, Orpington, Kent, tel 6673793 4-6.

TRS-80 16k L2... with 1/case mod, green screen, cass rec, under warranty, hardly used, £400. Tel 01-778 8835.

ZX80... working, special heat-sink, built, leads, PSU, manual, progs, £70. Tel 01-397 6792.

PET 8k... small keybrd, exc cond, soundbox, dust cover, s/w inc m/c Space Invaders, £390. Mr K Hashimoto, 16 Hartland Rd, Epping, Essex.

UK101... 4k RAM, sound int brd with spkr, transformer, cased, 300/600 baud cass int, new & old ROMs, fully switched & socketted for TV, monitor, cass, all leads inc, tape s/w inc Invaders, extended m/c monitor, manuals, Basic course, info, £225. Tel Elstead, Surrey 702135.

AIM... Rockwell Exorciser-compat exp board, all documentation plus 3 new (Vector Inc) prototyping boards for AIM or Motorola systems, cost over £200, £80 complete or sell separately. Tel: Mike Grimwood, Royston (0763) 60762 after 7.

Nascom II... 16k RAM, key-board case, £70 of software inc Space Invaders, tested by prof engineer, works perfectly, selling because of move to University. Tel: Jonathan, 05305 3824 after 4.

ASR-33 Teletype... with paper tape punch & stand, in good cond, £220 ono. DEC RK-8 12 Mbyte disk drive in good order with manuals, £400 ono. Tel: 0206 45099.

Olivetti TE338... terminal, 110 baud, RS232 full duplex int, 120 col carriage, paper tape punch & reader, roll or pin feed, good working order, can deliver most areas, £185. Tel: 0670 712624 eves.

Casio fx502p... good cond, prog library, instruction book, original box, £60ono. Tel: 021-355 5458 after 5.

UK101... 8k RAM, cased & fully working with software, £220 ono. Tel: 041-942 8813.

UK101... new monitor in ROM with orig instruction sheet, £16. Tel: Dave, 0442 42603.

UK101... 8k RAM, new monitor chip, cased, plenty of games inc 'Space Invaders' books inc 'Programming the 6502' and '6502 Applications', all with cassette recorder, £300. Tel: 051-724 5563 eves.

Hardware/software... for TI58C prog calc, eg cass int, printer port, any hardware adds/peripherals. Tel: Rob, 061-445 9385 after 6.

FA1... cass int for fx501/2p, also Sharp MZ-80K. Tel: Burgh Heath 57327.

Two VDUs... (Hazeltime or Pericom), One TUART S100 I/O board, one day/date S100 clock boards, and 2 DMB6400 S100 64k RAM boards. Harold Easton, 7 Ingrebourne House, Broadley St., London NW8, tel: 01-723 5822.

Radio control equipment... to exchange for a suitable working micro. A Jenkins, 55 Ash Grove, Craigshill, Livingston, W Lothian EH54 5JH.

Nascom 2... 32k RAM, 8k Basic, 4k Zeap2 and 2k Naspen in EPROM, Graphics PROM, PSU and Video 100 monitor, offers over £500. Tel: Ascot 21935 after 6.

TRS-80 L2 16k... with green screen, cass rec, Edtasm, Renum, Invaders, books on assembly language and Basic programming techniques, Level 1 and 2 manuals, 6 months old, as new, £500 ono. Tel: (0273) 501901 eves.

Sinclair ZX80... 6 months old, as new, sinc built, with book, adaptor etc, £50 ono. Tel: Northwick (0606) 41995, after 6. Book '30 programs for the ZX80' also for sale.

ZX80... assembled, perfect condition, complete with PSU, 1e leads, manual and ex board with 3k static RAM, £90.

48k ITT 2020... + disk drive, controller, paddles, Oki, microline 80, interface card, will separate, offers to 01-961 6013.

Brand new... Video Genie, with sound, tapes (Star Trek, The Count, X Wing II) plus demo tape and manuals, £300 ono. Tel: Hartlepool 60281.

Viscount M70... electronic organ, two key board manuals + 13 pedals, piano, harpsichord, clavichord, + orchestral voices synthesised strings on lower manual & full automatics, walking bass, clarinet counter melody + sheet music + Stax + headphones, £650 or exchange best micro offered, preferably PET or Apple. Tel: 01-455 1652.

Video Genie... 16k, 4 months old, plus manuals and some games tapes, (Star Trek, Super Nova & Galaxy Invasion), £300. Tel: Crawley 35003.

PET 2001... 8k, inc Soundbox, manual, PET Revealed, mags, lots of software inc Space Invaders, Word Processor, 3D OX, etc, original packing, £375 ono. Also Creed 7B teleprinter, £50 ono. Tel: 061-747 0284 (home), 061-748 3363 (work) or call at 62 Cheriton Road, Flixton, Manchester.

ITT 2020 48k... colour, 6 months old, swap for Apple II with less memory or just b&w. Reason: hi-res display incompat with some commercial games progs. Excellent chance to upgrade bus system! Tel: 0602-255935 eve.

Acorn Atom... 5 months old, hardly used, can be seen working, £150. Tel: Coventry 62038 eves, Mon-Thurs only.

Philips G7000... Videopac computer, takes cassettes, range of about 35, complete with 2 cassettes & hand controls, cost £100 new, will exchange for ZX80 or sell £70 ono. Tel: Clitheroe 24336.

8k PET... & cassette tape Toolkit, int Soundbox, tape monitor, full set TI workbooks (6) in brand new cond, very large collection progs inc mini assembler, Space Invaders, super rhino, Othello, fully serviced, £425 ono. Tel: Tony, Looe 2333.

Honeywell... high speed paper tape punch (150 ch/sec), 5/7/8 channel with auto tape winder, 10 V PSU & some transistor driving circuitry, needs very minor mechanical adjustment, offers. Tel: Loughborough 216164.

PET 8k... small keyboard, int cassette, automatic fan, software, quick sale, £300. Tel: Coventry 501099.

UK101 8k... cased, with 48 x 32 display, £150. Smart 2 ext 16k memory, with PSU, £100. Eascomp sound board (inc 2 I/O ports), £30. Compshop's new monitor ROM, £16. Video 100 monitor, greatly improves definition, £60. Tel: Gordon Bevis, Portsmouth 731151 after 7.

Nascom 1... with NasSys 3, Nas-dis, debug, assembler, graphics, sound, all in box, plus extras, must be seen. Also Oki Microline 80 printer, brand new, £900 or may split. Tel: 021-351 4881 after 7.

Acorn Atom... 8k ROM, 3k RAM, mains adaptor, all leads & manual, built & running, as new, £130. Teleton 12" b&w TV, 1 month old, £40 or £160 for both. P Smith, 21 Lamerton Close, Bordon, Hants GU35 0HZ.

MK14... RAM I/O, extra opt RAM, SoC revised monitor, cass int, £40. Steve Birch, 18 Eardisley Rd, Allerton, Liverpool L18 0HS.

UK101... 8k RAM, 8k ROM, cased, all leads, new monitor, £250 ono. Tel: 01-363 5961 after 5.

FREE 2001-8k PET... to anyone who'll give me £325 for my sound box! Lots of software thrown in as well! Also - Epson TX80 printer with PET interface & cable (usually £60 extra on top of advertisers prices!), offers around £340 on 01-886 7354.

32k Apple II+... disc drive with control card, integer card, Sony 9" B/W monitor, plus plenty of software worth £250.00, all for only £1290. Tel Jay on 01-440 8731 eves.

TI 58C... prog calc & PC100C with math/utilities, leisure modules, constant memory, full doc and dust cover for PC100C, 12 mths old, £170 ono. Tel Medway 375500.

TRANSACTION FILE

Anadex DP-8000 . . . printer with Bailey IEEE — RS232 interface, suit PET and disk system, complete with manual, leads and plugs, £400 ono. J Nuttall, St John's Seminary, Womersley, Guildford, Surrey. Will gladly demo.

Nascom 2 . . . 32k RAM, built by Interface, NASPEN, TOOLKIT, Graphics ROM, Kenilworth case, 8 months old, inc tape rec, portable TV, Creed 7E teleprinter with interface and software, taped software, two programming books and INMC publications. Cost over £800 new, yours for £600. Tel: Bourne End (062 85) 23454.

TRS-80 L2 16k . . . with c/recorder, VDU, power supply, manuals, some cassettes with games, only 4 months old. £400 ono. Tel Mon-Fri, 8-5, Huntingdon 52451 ext 384, ask for Martin.

Basic 77-68 . . . cased, working, complete with PSU, all switches, manual, ready to expand, £60 ono. Tel Littlewick Green 3235

AIM 65 . . . Rockwell Exorciser-compatible expansion board with all documentation PLUS three brand-new (Vector Inc) prototyping boards for your AIM or Motorola system. Cost over £200, £80 complete or will sell separately. Tel: Mike Grimwood, Royston (0763) 60762 after 7.

32k Sorcerer . . . Basic and assembler/editor (in ROM) with manuals; V.g. working cass rec, motor-control cable for 2 recorders/modem connection; Startrek, Adventure, terminal routine software, plenty of Sorcerer literature, £640, ono. Ring 01-670 1828

Nascom 32k . . . boxed, floppy tap tape drive, Pascal & Assembler, £550 ono. Write: B L Giles, London Rd, Daventry, Northants NN11 4DB

Exidy Sorcerer . . . word processor pac, £90; development pac £60, as new, 01-946 8467 (eve).

Apple accessories . . . Videx keyboard enhancer, £80; Super-talker, £148; M&R Super Fan, £39; Tractor for Microline-80 Printer, £37; Bit copier ('Lock-smith'), £99; Smart-Term 80 column board, £185; Z-80 Soft-card, £165; Applesoft firmware card, £90. Tel: Cobham (Surrey) 5371

UK101 . . . 8k RAM, Microtype 3 case, sound board, new monitor, 1 or 2 MHz switch, leads & documentation + dozens of tapes, perfect operation, £250 negotiable. Also Creed 3B printer + interface for UK101 £80 + carriage. Tel: 041 956 1768.

Boris . . . multi-level chess computer in beautiful walnut box, mint condition, £115 inc board, pieces etc: tel Aylesbury 27357

PET 2001 8k . . . VGC plus manuals, green screen, soundbox, joystick, reset button, cover, £20 £200+ worth of software inc Microchess, WP, Invaders, Adventure, m/c monitor, 6502 assembler business & educational, first offer over £350 secures. Tel: Crawley (0293) 24504.

Atom . . . 8k + 2k, PSU, all manuals, some simple programs, £175. Write: P Norman, 84 Welland Way, Oakham, Leics LE15 6SL.

Percom LFD-400 (Siemens FDD-100) . . . double-sided mini disk drive, controller card with Minidos, Minidos Plus DOS 2k ROM, operates on any 6800 system, cased, interconnecting cable, diagrams, listings, 4 disks, assembler, editor, flextran, index, all items brand new, genuine reason, £320 ono. Welwyn Garden City 29668

Nascom 2 . . . 16k RAM, PSU, graphics ROM, Vero case & keyboard enclosure, £410. Tel: Weybridge 53680 eves.

TRS-80 Pocket comp . . . VGC, with manual, box, cless, carry pouch, owner gone micro, first offer of £89 gets free cassette interface and many progs. S Hutt, 138 Springvale Rd, Kings Worthy, Winchester, Hants

Casio FX502P . . . prog sci calc, £50 (ono). Tel Gary Newmarket (0638) 68964 after 6.

TRS-80 12 16k . . . with monitor, cass rec, covers, various taped programs inc Chess, Maze, Black-jack, many books inc Learning level 2, The Basic handbook, over 60 mags (PCW etc), desk, £350 ono. Tel: Basingstoke 28729 after 4.

ZX80 . . . 2 months old, VGC inc Basic manual, all leads and mains adaptor, £75. Tel Abingdon 24762.

Chess Challenger 7 . . . little used, £75 ono with mains adaptor, P Stilliard, 55 Morley Rd, Twickenham. Tel: 01-892 1909

Sinclair . . . 3k RAM expansion for ZX80. Only £22. Tel: 0256 75717.

ZX80 . . . 1k, working, assembled, inc. all leads, PSU, manual and 40 progs on tape £80 ono. inc p/p UK only. Binetone cassette recorder (easy load/save) available if required £15 G Barrett, 465 Marine Road, Morecombe, Lancs.

T159 . . . complete with charger, master and business decision modules, programming pakette, all manuals and Engelsohn's book 'Programming with Programmable Calculators' £110 ono. Steward Watford 35352, eve.

Acorn Atom -12k + 12k . . . with 3A PSU, assembled and working, £220 inc postage. Write K Yeap, Northampton Hall, Bunhill Row, London EC1Y 8LJ

Sharp MZ-80K . . . 24k RAM, VDU and cassette, 6 months old, hardly used, excellent graphics, inc Basic manual and tape, 8 games and Demagnetiser, best offer over £380, secures. Tel: (77) 44935 (eve).

ITT 2020 . . . colour computer + 48k RAM, excellent condition, over 100 superb programs incl many popular games, paddles, manuals and original packing incl included. £800 ono. Tel Telford 594540.

Centronics 101 printer . . . 165 cps, 132 col £225; SWTP CT64 Terminal £200; Marconi Elliott Videodata 4000 terminal £125; Autonomics VDU with 35mm back-projector (not working) hence only £15. Tel 0525 220261.

S100 . . . 4k EPROM board, uses 1702 PROMs, working, complete with 1k of erased PROM £30. Tel Camberley (0276) 61543 after 6.

Teletype 43 . . . approx 1 year old, together with free interface and driver software for TRS-80 Mk 1, originally cost over £800 accept £425. Tel 01-539 7756, after 6.30.

ZX80 . . . Sinclair built, inc all leads, adaptor & manual, still in maker's box, only 2 months old, works perfectly, bargain at only £75 (cost £100), inc postage. Tel: 01-571 4461 (eve) ask for Tarik.

Micro Technology . . . K-1007-1 interface for use between old style PET and MTU high resolution graphics and other boards, £30. Tel: 01-398 2902 evenings after 8/weekends. Copy manual available to check suitability.

Sinclair ZX80 . . . all leads, manual, £16 worth of software (including active display progs), book (make the most of your ZX80), inverse video switch connected, no PSU. All for £55. J E McGrath, 2 The Green, Lilbourne, Warks. Tel: Swinford 670

Superboard . . . 4k, PSU, modulator, offers around £170. Tel Dr M Pilling 061-793 5000 ext 425 office hrs.

Texas Silent 700 . . . terminal with full ASCII keyboard and electro-thermal printer, RS232 and V24 at 300 baud, £150. Paul Marshall 03302 2688 (eves)

ZX80 . . . Sinclair built, as new, three months old, complete, inc leads, mains adaptor & manual £50. Tel Chester 36242.

HP41-C . . . calculator complete with maths & circuit analysis modules, case etc, £120 inclu. both application modules. Alan Hains, tel Bracknell 51811 ext 42 office hrs, Windsor 64026 eves & w/ends.

ZX80 . . . assembled, little used, complete with all leads, Sinclair mains adaptor and manual, ZX80 Magic Book, leaflets and information about the Users Club. £85. Tel Ilford, 01-554 3997.

ZX80 . . . bargain, Sinc built, original packing, perfect working order, 3 months old, over 30 programs inc moving graphics, Breakout, Space Invaders (requires 2k), £70 ono (unwanted gift). Tel: 021-742 8422 eve.

Nascom 1 . . . built & tested, Nas-sys 1 and 2k integer basic, 4k RAM & PSU all housed in 19" frame, with full documentation, £185. Tel: Chalfont St Giles 2966.

Nascom 1 . . . + PSU (Nas-sys monitor), inc all manuals + programming the ZX80 (Zaks), fully built and in completely working order. First £70 secures, P Corrigan, 112 Clarkston Rd, Cathcart, Glasgow.

Sinclair built ZX80 . . . 3 months old, inc leads, mains, adaptor, original packing, 2 books, cassette & several program listings, all for £85. Tel Luton 51986 after 6.

Sinclair ZX80 . . . as new, all leads, PSU, and manual, Sinc built £70. Tel: Baintree 44712 or write Andy Pierce, 208 Cressing Rd, B'tree.

ZX80 . . . Sinc built, PSU, leads, manual, loads of software (programs inc Breakout, Lunar, Lander, Clock), £50 Tel: Coventry 613816.

Video Genie . . . 16k, 3 months old, inc sound and many excellent progs. (Galaxy, Timetrek etc), £250. Tel: 021-501 1359.

ZX-80 . . . 1k Sinc built, all leads, manual, adaptor etc, perfect working order. £65 ono. Tel: 01-769 2115 eve.

Challenger 1P . . . 8k, few months old, all manuals, few tapes, £280 ono. Tel: Maidstone 678782 6 — 8.

ZX80 . . . Sinc built. As new, complete with PSU, manual and leads, £50. Tel: Reading 695842.

TRS-80 LII 16k . . . inc. video monitor, tape recorder, some tapes inc debug, £350. Tel: Westbury (0373) 823764.

ZX80 . . . with 8k expansion, manual and all leads, cassette of utility programs (inc machine-code driven display) and user club magazines, £50. Tel: 061-773 6468

PET 2001-16k . . . Old ROMs, soundbox, Petsoft Basic tutorials + other software and games, ideal for beginner, £450 ono. Tel: 092685 616.

UK101 . . . 8k RAM, new and old monitors plus documentation, 1/2 MHz and 300/600 baud cassette I/F both switchable, cased, blower fan, power supply mounted separately, utilities and games on tape including Basic line renamer and m/c code Invaders, £220. Phone Hemel Hempstead (0442) 45014.

Acorn Atom 12k+12k . . . with PSU manual, leads etc, fully assembled and tested, in pristine condition, £255. Tel: St Mary Bourne 424.

TRS-80 L2 16k . . . inc manuals, T-bug, editor/assembler, instant sort/search database, sargonii, startrek, backgammon, £300 the lot. Buyer collects. Phone 01-906 1966 eve.

ZX80 . . . Fully ass, working, inc. manual, mains adaptor, all leads 'Magic Book', £90. M Grant, 1 Craigpark Rd, Scalloway, Shetland. Tel: 595 88 394 after 6.

CEGMON . . . for 32 line UK101, £25. With 32 line conversion £33. Also 16 line Compshop New Monitor £15. T Kenahan, 109 Devonshire Drive, North Anston, Sheffield, Yorks. Tel: Rotherham 60166 ext 3250 (office hours)

ZX80 . . . complete (all leads, manual, adaptor), Sinc built, several progs, £50. R J Hollick, 34 Woodvale Rd, Gurnard, Isle of Wight.

ZX80 . . . Sinc built, as new, complete with 2 excellent program books — 30 Progs for ZX80 and ZX80 Programs Vol 1, value over £10, also 2 tapes with numerous games — accept £75 the lot, Ms Watts, 90 The Clarksons, Barking, Essex.

ZX80 . . . Sinc built, good condition, inc adaptor, leads, manual and a few progs, ideal first computer, first offer around £50 takes. Tel: 031 552 2503.

S100 16k . . . Static RAM boards (2114) with bank select £120 each (2); S100 Ithaca Audio disk board, untested, so £75. ono. INS 8295 (NIBL) £15 ea; 2102's, £2.50 per 8. Tel Dave, 02367 36570 after 6.

TRS-80 48k . . . with twin 125k drives using Newdos-plus, all manuals including TRSDOS and tape EDT/ASS, virtually unused, £1100 ono. Caterham (0883) 47320 evenings, Brighton (0273) 559711 ext 39 ask for Jim.

Suberboard II . . . 8k RAM, cased, complete with manuals, programs and a book of game programs, as new £250 ono. Tel: 01-554 9548.

Olympia type SGE 50 . . . input/output typewriter with interface boards and multi-way plug, £120 ono. Bowmansgreen 23824 (St Albans).

Ohio Scientific Superboard IIE . . . (32x48 format) 8k RAM, A Y-8910 programmable synthesiser, power supply, cassette recorder, some tapes and an ASR33 teleprinter which needs an interface, £300 ono the lot. Contact Gino Masoero on 01-759 2811 Ex 41 working hours.

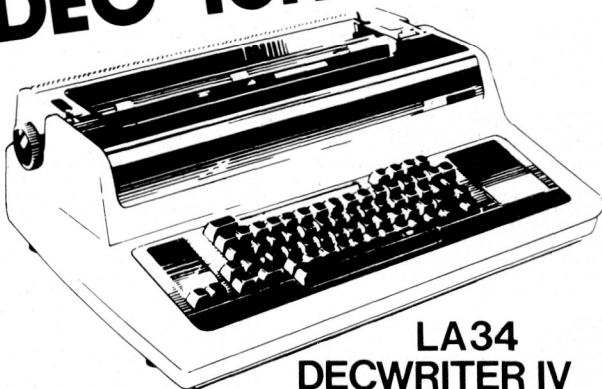
IMSAI 8080 . . . desktop micro-computer (8080/S100 based), CPM/IMDOS, 32k RAM ext 65k, 3 S-I/O + 2P-I/O + F/D controller (8080/Prog-EPROM) with matching unit dual 8" F/D drives, very good con., complete with H/W and S/W manuals, £1850 ono. or exchange scale steam locomotive/traction engine. Tel: 093-781 330 (Yorks).

ZX80 1k . . . Excellent cond, only 3 months old, Sinc built with mains adaptor and leads (inc. Special cassette lead which allows you to monitor the loading of programs), £70 ono inc. cassette software and UK postage. Tel: 0632-863713 after 4.

Nascom RAM-B . . . board, working, tested, with 32k RAM and diagnostic on tape (N1 format), £180. Write: Graham Honigman, 63 Kew Green, Richmond, Surrey TW9 3AH.

UK101 . . . cased, 8k, new monitor, assembler on tape, and a couple of games, £225 ono or Acorn (0359) 50619 (Stanton, Suffolk) eve.

Wilkes Computing for DECTM Terminals



LA34
DECWRITER IV

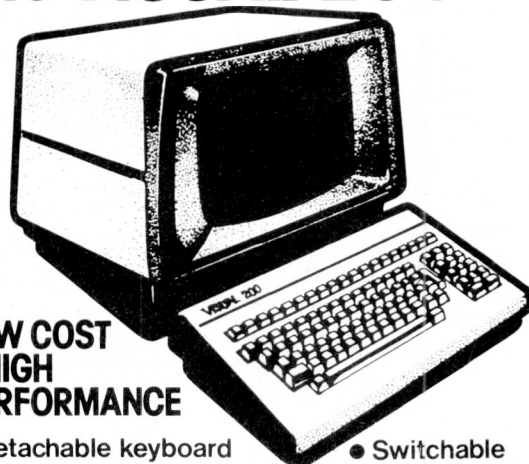
- Desk Top ● 30 cps
- Full 128 ASC11 Character Set
- 4 Character pitches
- 6 different line spacings
- Left and right margins
- Optional forms control
- LOW PRICE

TM Digital Equipment Company Ltd.

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Announce The VISUAL 200



LOW COST -HIGH PERFORMANCE

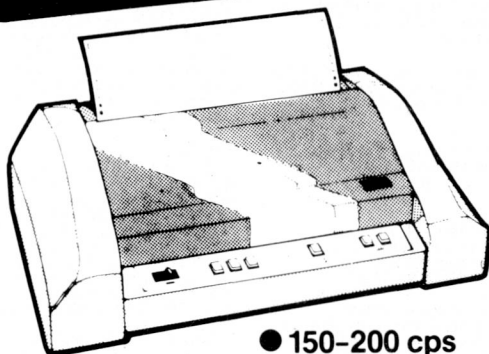
- Detachable keyboard
- Numerical pad
- Upper and lower case
- Editing
- Smooth scroll
- Cursor addressing
- Printer port
- Switchable emulations
- DEC VT52
- Hazeltine 1500
- Lear Seagler ADM3A
- ADDS 520
- Many more standard features and options

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Present

the Anadex DP9500



- 150-200 cps
- Bi directional smart printing
- 132-176 columns ● Complete forms control
- Horizontal and vertical tabs
- Double width printing ● 9 wire print head
- High density graphics ● Up to 9600 Baud

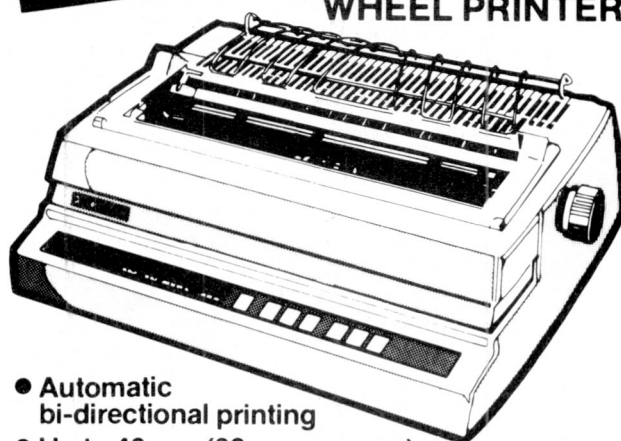
Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Announce

DIABLO 630

DAISY WHEEL PRINTER



- Automatic bi-directional printing
- Up to 40 cps (32 cps average)
- Interchangeable metal/plastic print wheels
- RS232-c or 20 mA interface
- Word processing options
- Optional tractors ● Optional cut sheet feeder

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

8k PET... integral cassette plus several games programs inc Micro chess, also books and manuals, £350 the lot, Phone South Ockendon 7755.

ZX80 1k... fully assembled inc, manual, leads and cassette of software, but no PSU, £50, 6-level chess computer £30. All of above for £75. Tel: 051-342 4446.

ZX80 1k... fully assembled (in box) with manual, mains adaptor and leads, as new, £55. Tel: 051-648 4362.

ZX80... 3 months old, Sinc built with PSU, leads, manual and cassette of 30 prog, £75 ono. Tel Mildenhall (0638) 713933.

ZX80... Sinc built, inc mains adaptor, manual, leads, and separate programming course book and cassette plus many games on cassette, inc draughts, '30 Progs for ZX80' book, worth at least £130, sell for £75 ono. Phone Kevin on 01-449 1049

PET 2001-8k... as new, inc, assembler, micro chess and Space Invaders, £320. Tel: Bitton, Bristol 027588 5040.

Video Genie EG3003... with joysticks and sound box, 2 months old, several prog and manuals, £320. Can deliver with-in 20 miles Heathrow. Tel: Colnbrook 3328.

ZX80... ex condition, inc, manual mains adaptor and all leads, genuine reason for sale, £60. Tel: Ware (0920) 3772, eve and w/ends.

ZX80... with 16k RAM memory expansion, inverse video switch, spare case, extra long cassette wire, fully working with manual and power supply, £130 (owner getting larger machine). Tel: 01-340 6545 (Matthew).

Sharp PC-1211... pocket computer 1.9k continuous memory, Basic, with cassette interface, beginners Basic, instruction manual; ideal if you're just starting out, cost £120, accept £100. Tel: Richard Upminster 23222.

Tangerine Microtan 65... prof, built, cased, perfect working order, hex keypad, power supply and manual, programming the 6502 (zaks), space in case for tanex, cost £120, will sell for £100. Tel (after 5pm) Owain, 06234 4446.

Sharp PC1211... Elf II, Sinclair Cambridge programmable calculator, Tandy keyboard EA 24031, all with instructions manuals in good working order, ideal teaching outfit posted, packed and insured for £125 or may split. Write: D J Merryweather, 82 Southbury Rd, Enfield Midx EN1 1YB.

TRS-80 L2 16k... 2 months old, perfect condition, inc numeric keypad, manuals, TV mod etc, plus Tandy software, IQ builder, budget management, casino games, Basic course part 2, £300. Write LT Cdr PJ W Thompson, Wardroom, HMS Nelson, Portsmouth.

Diablo 1650 KSR... daisy wheel terminal, brand new, unboxed worth £2100, also second-hand AJ630 matrix ASCII/APL terminal, good working order. Offers to 01-864 9537 eve.

Aculab floppy tape... plus over £40 worth of wafers, suitable for TRS80 or Genie, first £130. Tel: 021-350 6464.

Sinclair ZX80... Sinc built, PSU, leads and manual, 2 months old, over £20 of software, £80 the lot. G Mairs, 2 Heathcote, Stoke-on-Tern, Market Drayton, Salop TF9 2JJ.

ZX80... Sinc built, boxed as new, 8 weeks old, PSU £85. no offers. Tel: Crawley 512043.

ZX80... with 16k RAM pack, Sinc built with all leads, adaptor and manual, in perfect working order, £100. Tel: Abson (027 582) 2380 (w/ends only)

ZX80... standard 1k, Inverse video switch, all lead to connect to your TV and cassette recorder, instruction manual, all in original box, 6 months old (no mains adaptor) only £50. Tel: Wellington (Somerset) 2095.

ZX80... Sinc tested, boxed with 16 programs on cassette, with all leads, manual & adaptor, ready to use on your own TV, cost £100, selling for £65. Tel 01-606 9274/5, office hours. Ask for Mr Plumb or leave message if out.

Anadex DP8000... printer, 96 ASCII set, 84 lines per minute RS232 int, £290 plus carriage. Tel: Bradford (0274) 875503 or 872546.

ZX80... boxed, inc PSU, manual, leads and comprehensive program library, only £60. Tel St Albans 61712.

PET 2001... 8k (old ROM) plus £100 worth of various software: games, utilities, statistics, basic tutorial, small keyboard, built-in cassette recorder, £350. Tel: 01-769 5002.

ZX80... as new with 16k add-on RAM £90. Tel: 0977-554105 day 552525 eve.

Keyboard & video... S E Labs computer terminal type 2000, 80x24 line display, 600/1200 baud, switchable, £65. Tel: 01-788 0045

Acorn Atom... 12k ROM, 12k RAM, fitted with the new colour encoder, fully tested by Acorn, £265; 5 volt 3 amp PSU housed in handsome metal case with room to fit 3 extra eurocards, £30; Acornsoft games packs 1 and 4 and soft VDU pack, £10 each; Sinclair ZX80 £60; S R Jones, 5 Kings Road, Mumbles, Swansea SA3 4AJ.

ZX80... 3k extension board, with 1k already plugged in. Fits into rear of ZX80, £15 ono. Contact S Shorte, 12 Colwick Clse, London N6 5NU, tel 01-272 1655.

TRS-80... pocket computer as new, cassette interface, 2 games cassettes and full instructions, £100 ono. Cassette recorder if required. Tel: 01-892 0836 eves.

Texas TI59... calculator and printer, spare rolls of print paper, maths utilities chip, manuals, all in original boxes, cost over £450, will accept £150 ono, Tel Colchester 73744 eve or w/ends.

Acorn System One... Inc additional RAM/IO device, PSU and 'Programming the 6502' by Rodney Zaks. Contact D Elworthy, 3 Carrwood Road, Wilmslow, Cheshire; or at St Catherine's College, Cambridge during term time. Price: £55.

Nascom 1... on alum chassis, with PSU, manuals, £150. Can only be seen Sats, 2 extra EPROMs free. Tel 01-200 0444 ext 214 (office).

Wanted

Printer... suitable for TRS-80 16k level II, also Aculab floppy tape or equivalent. Write: Mr G Wernham, 47 Strichen Rd, Fraserburgh, Aberdeenshire AB4 5SA.

Acorn Atom... or ZX81, must have leads and manuals, tel: 01-764 4453 after 5.

Student... requires personal micro, 8k ROM, 2k RAM or more, Basic, with manuals. Collect if in area, otherwise make suitable arrangement. Any possibles, details to: G Wilson, 27 Servia Drive, Leeds LS7 1NN, Yorks.

Computer work... 2nd year university student seeks summer vacation work. Programming, keying-in programs or data, etc, are possibilities. Please write Mr S Barrett, 10 Tuttle Lane (East), Wymondham, Norfolk NR18 0EN.

Nascom 2... in working order. Tel: 01-977 8305 eves.

Computer mags... wanted by new enthusiast - reasonable. G H O'Reilly, 96 Boulevard North, Bayside, Dublin 13.

Apple II or Apple II plus... recent model. Offers over £550 for TRS-80 model I Level 2 with quick printer, editor assembler. Plus, level IV Basic, adventure, pyramid, incomplete records and sundry software. Tel: Sheffield 304467. eve.

Lonely... Sharp MX-80K would like to meet local compatible printer with a view to occasional interfacing. (Non-technical owner wants occasional hard-copy listings.) Tel Rugby (0788) 815612.

48-64k RAM... Z80 processor with 5 1/4 or 8" floppy and keyboard, able to run CP/M. Tel 0209 831274.

PET 8k... 16 or 32 with cassette deck, will consider similar set-up, tel 0492 67288.

Computer fanatic... wishes to purchase a 16k Nascom II. Anybody who wishes to part with their working machine for around £250 please contact M Riley - 174 Avenue Rd, Erith, Kent DA8 3AZ.

FEB 1979... issue of PCW to make up a complete set. Ring 0603 811005.

PET... 16k or 32k, large keyboard, new ROMs, green screen, willing to pay up to £400 cash. Ring Mike, Nazeing (Essex) 3654.

TRS-80 4k... or 16k L2 or Video Genie & any s/ware etc. Tel Sacriston 711904 eves.

Acorn Atom... UK101, Superboard, or sim. If Atom, pref with 4k RAM & col graphics brd. Tel Hartlepool (0429)

PCW back issues... Vol 1 nos 5,6,12; Vol 2 no 8. Will pay £1.50 ea. Write: Njal Fisketjon, Dalsveien 42a, N-4000 Stavanger, Norway.

Video Genie... or Acorn Atom, 12k ROM+12k RAM, in working order. Tel David Lever, Warrington 61087 eves & w/ends.

ZX80... must be in good cond. Tel Tadley 5930 eves & w/ends.

ZX80... Sinc built, with PSU, pay approx £70. Tel Phil, 021-459 5069.

Compute... Vol 1 no 6 (Sept/Oct 1980), good price paid. Also want complete set "The PET Paper" to date. Ron Casan, 15 Parkway, Sawbridgeworth, Herts CM21 9NR. tel 0279 724037.

16k memory extension... for ZX80. Send details to D Nuttall, 10 Sandhills Ave, Blackpool, Lancs FY4 1QQ.

Micro wanted... PET, Apple, Tandy or sim, up to £200. Details to: D Dunmail, 70 High Ash Ave, Leeds LS17 8RT.

PCW... Vol 1 nos 4&5; Computing Today March, June, Dec 80, Feb 81; Practical Vol 1 nos 1,3, Vol 3 nos 11,12, vol 4 no 1. Tel Peter O'Rourke, 051 486 6837 eves.

Impoverished but keen... teacher needs back issues of computing mags to satisfy demands of next generation of programmers: PCW, Practical, CT, Creative - you send it, we'll use it. J P Elsmore, Hill House, Beacon Hill, Woking, Surrey GU21 1QR.

Acorn Atom... 2k RAM, in reliable working order. R Doyle, tel 01-546 6646 eves, Ashtead 778811 day.

MZ-80K... descript & price to W Prescott, St Anselms, Stratton on the Fosse, Bath.

IBM golfball... printer or 735 I/O typewriter, any cond. A Smith, Head of Science, Wallingford School, Oxon, tel 0491 37115.

UK101... 8k RAM, cased, plus software worth £40, only £220. Tel: 01-251 3769 eves.

UK101... cased, 8k RAM, new monitor, assembler, some games inc Space Invaders, only £320. Write Mark Posen, Churchill Hall, Stoke Park Rd, Bristol BS9 1JG.

TTY ASR28... keyboard, printing, perf tape transmitter reader, page printer, with motor start relay & 3 handbooks, working when taken off circuit, £20 buyer collects. Tel: 01-242 4433 (day), 0732 62227 eves.

PET 8k... new ROM, large keyboard, green screen, cass deck, h'ware reset switch, manual, 'PET Revealed', a few progs, £370 ono. Tel: Cliff, 01-671 3265.

Video Genie... EG3003 16k, sound unit, tab key, plenty of software, £285 ono. Tel Stoke-on-Trent 642819.

PET 2001 8k... £325 ono. PET cass deck £40. PET int to TX80 printer £15. Tel: 01-550 0546 (day), 01-550 3595 (eve).

Has anyone... out there got a disk drive to sell for around £100? Please contact Chris Payne at Rose Cottage, Ewell Minnis, Dover, Kent or phone 03047 4550.

ZX80... any condition, will pay up to £25 or swap for AM/FM radio cassette recorder in good cond. Ring Graham, 0394 33267.

ZX81... with 16k RAM (if possible) & programs, adaptor etc, will pay generously. Tel 051-928 1245 after 4.

TRS-80 LZ... stringy floppy unit. Contact M Pedley, Christ Church, Oxford.

Business Studies Student... requires system for 3rd year project, preferably 32 TV 64k RAM, 80x24 monitor, disk storage, printer? eg Superbrain. Have IBM golf-ball printer with RS232 interface, approx £1000 to spend. Phone Rochdale 354521.

HP9845... or other 16-bit system for DATA processing in exchange for my 1954 Austin Healey 100/4 BN1, plus massive spares backup. Tel: Ken Bower 01-953 6161 Ext 12, office hours or Bowmans Green 25114 eve.

Add-on memory... for ZX80-ZX81, could swap a 5V.15A or a 24V 5A regulated power supply both with manual control of amplified remote voltage sensing. D Noble, Billiemaans, Duns, Berwickshire, TD11 3LF, Tel Chirnside (089 081) 526.

Teletype ASR33... Teleprinter, paper tape punch and reader, full RS232 interface, working at present with Nascom 2, complete with stand and all accessories, goodcond, £110. Will delivery 50 miles of Liverpool. Tel: 051 487 9586.

ZX80... Factory built, working, inc PSU, leads, manual and cassette of 25+ programs, £75. Tel 0905 21664.

ZX80... Sinc built, complete with all leads, adaptor and manual, good cond and full working, £70. Tel P Kao 01-247 3740.

For sale

Nascom 1... 8k user RAM, Nas-sys and Nasbug monitors, buffer board, 8k Basic ROM, Zeap 2 on tape, Super Tiny Basic, 3 amp PSU, all in Vero case, manuals and programs, worth £450, accept £350 ono. Tel: Newark 76415.

Disk Nascom... 64k/4MHz Nascom 1 with twin drive CP/M Gemini disks and software and Anadex DP8000 printer, 2 par/2 ser ports, expanded keyboard, graphics and monitor, cassette interface, to 2400 baud, all as new, sensible offers. L Stroud, evenings Castleton., (N Yorks) 281.

ZX80... Sinc built, all leads and manuals +2k memory expansion board, 3 months old and inc book and live action breakout and

Space intruders, other software also, cost over £170, sell for £120 ono. May sell expansion and ZX80 separately. Tel: 021-783 8345.

Casio FX502P... £65. Tel 01-949 0120 after 6, ask for Mike.

ZX80... Sinc built, inc adaptor and leads, etc. 'Making the most of your ZX80' Tim Hartnell also included. Excellent working order. Reason for selling is upgrading 2 months old. Inc Sinc manual, £65 p+p. Tel: 01-508 6200 (Loughton - Essex) eve only.

Sharp MZ-80FD... twin D/S disk drive, interface card, all cables, handbooks, DOS etc, and some software, £550 ono. Tel: Blackburn (0254) 63644 ext 25 (Dave)

TRS-80 16k L2... system, manuals leads, dust covers, Galaxians, Asteroids, Scripsit, 4 mths old, £350. Crayford 54942 (eve).

ZX80... fully assembled and complete with all leads, mains adaptor, manual, etc, perfect condition, £55 ono. Berry, 246 London Road, Earley, Reading RG6 1AJ. Tel (0734) 663650.

Grandstand Video Entertainment Computer... still in box and in good cond. Complete with 10 carts: Backgammon, Maze, Robot War, Blackjack, Drag Strip, Baseball, Magic Numbers, Tic-Tac-Toe, Desert Fox, Space War, plus extra games and variations on most cartridges, the lot £95 ono. Phone Adlington (0257) 482311.

ZX80... as nw, boxed assembled plus '30 games for ZX80'. £106 value for £70 ono. Luton (0582) 33483.

TRS-80 Level II 16k... complete with lower case modification and CTR-80, modified cassette recorder for computer little used, with maker's warranty.

£390. Mr F J Syfield, 148 Parish Lane, Penge, London SE20 7JH

RS232 and DAC on board, also Atari Video computer, with 27 cartridges and all controllers, £550 the lot or will split: £230 superboard, £330 Atari. Tel Robert on Derby (0332) 701 964 after 6.

ZX80... factory built, power supply, manual and leads, only 3 months old, £75 ono. Tim Atkins, 82 Willow Way, Hurstpierpoint, West Sussex BN6 9TJ.

ZX80... Sinc built 3 months old, good condition with all leads and power supply unit, also listings of about 30 programs, will accept £70 ono. Tel: Brighton 501155 after 5pm. Deliver within a 50 mile radius.

NETWORK NEWS

Personal computer networks have been springing up all over the States for 18 months or more and now we have two in Britain. As more networks appear — and as more facilities are added to existing networks — we'll report them in this section, which appears monthly.

Forum 80... operated by Frederick Brown, tel: Hull (0482) 859169. No access charge, open to any micro owner. Operating Tues & Thurs 1900 — 2200, Sat & Sun 1200 — 2200. Facilities: bulletin board, program

library for downloading programs (all in Microsoft Basic), program uploading for adding your own progs to library: Forum 80 Users Group (membership free) enables access to programs not in public domain.

National TRS-80 Users' Group... being set up at time of writing, will be available to all micro users, not just TRS-80 owners. Initially access charge will be a £10 sub, but as more join, this

will be reduced and refunds made accordingly. Facilities: bulletin board & programs for downloading. Contact: Brian Pain, tel 0908 566660 (office).

USER GROUPS INDEX

These are updates/new entries received since our last full listing. The next complete list will be printed in our August issue.

INTERNATIONAL

KAOS — the official 6502 users' group of Australia. Has a range of projects within special interest groups: hardware, software, amateur radio, Pascal, education. Publishes monthly newsletter. Contact: Mr Ian Eyles, 10 Forbes St, Essendon, Victoria, Australia 3040

NATIONAL

TRS-80 Level 1 User Group. For Model I and Model III owners using Level 1 Basic. Produces bi-monthly newsletter, runs software library. Annual sub: £5. Contact (with SAE): N

Rushton, 123 Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

Educational Users' Group for TRS-80 & Video Genie. Offshoot of Nat TRS-80 UG, other TRS-80/Vid Genie users welcome. Contact: D J Fatcher, Head Teacher, Beaconsfield First & Middle School, Beaconsfield Rd, Southall, Middx.

DEVON

Plymouth and District Amateur Computing Club. Meets each Wednesday, 7 — 9pm at King Street Methodist Church,

Plymouth. Contact: Stuart Bell, 31 Victoria Place, Plymouth, Devon, PL2 1BY.

LANCASHIRE

N Lanes User Group. Covers Blackpool, the Fylde & Preston, meets monthly. Contact: John Robinson, 12 Harold Avenue, Blackpool or Julian Morgan on Blackpool 47514.

MERSEYSIDE

Merseyside TRS-80/Video Genie Users' Group. Contact: Peter Tootill, 101 Swanside Rd, Liverpool L14 7NL, tel 051-220 9733.

SUFFOLK

Suffolk Microcomputer Club. Meets monthly, produces newsletter, sub £5 pa. Contact: Mr S Pratt, c/o Microtek, 15 Lower Brook St, Ipswich, Suffolk IP4 1AQ, tel 0473 50152.

New ComputerTowns:

New Addington: Brigitte Gorton, 18 Pirbright Crescent, New Addington, Croydon CR0 0RT.

Caversham: Pat Colley, 52 Queensway, Caversham Park Village, Reading, Berks RG4 0SJ.

Gloucester: Steve Haynes, 5 Guinea Street, Kingsholm, Gloucester GL1 3BL.

DIARY DATA

London,	(West Centre Hotel) International Commodore PET Show. Contact: Baroness International on 01-734 2907	18 — 20 June
London	(Wembley Conf Centre) Int Word Processing Exbn & Conf. Contact: Business Equipment Trade Assoc, 01-405-6233	23 — 26 June
Sydney, Australia	Consumer Electronics Show. Contact: Riddell Exbn Promotions, 166 Albert Rd, S. Melbourne 3205	13 — 19 July
London	(Wembley Conf Centre) Microcomputer Show. Contact: Online, 09274 28211	13 — 19 July
London	(Cunard Int Hotel) Computer Software Exbn — SOFT. Contact: Executive Conf Organisers, 01-748 0287	2 — 4 Sept
Paris, France	Int Conf & Exbn Microprocessing and Microprogramming — Euromicro. Contact: Euromicro, 18 Rue Planchat, 75020 Paris	8 — 10 Sept
London	(Cunard Int Hotel) Personal Computer World Show. Contact: Montbuild, 01-486 1951	10 — 12 Sept
Anaheim, USA	Electronic Show & Convention — Wescon. Contact Network, 028 02 5226	14 — 16 Sept

PCW SUBSET

Alan Tootill presents more useful assembler — language subroutines.
If you'd like to contribute your routines (for any of the popular processors), send them to:
Sub Set, PCW, 14 Rathbone Place, London W1P 1DE.

Before we get immersed in any code, it should be said that we have been taken to task for printing, in Class 1, routines that alter registers that could be returned unaltered. Other readers think that, in order to make the use of multiple/conditional RETURNS easier and economical, general purpose routines should not be obliged to save all registers possible, provided what they do is declared. Some processors have so few registers that they are not expected to carry values beyond the immediate processing task anyway.

The standard for Sub Set is that Class 1 routines are re-entrant, position-independent, not self-modifying and return unaltered all registers and flags, except those declared as being used to pass information to and from the routine. So we are aiming to keep to this in future. Routines that are not Class 1 for any good reason can be just as interesting and will still be printed.

In February's issue we posed the problem of PSHEM, which saved registers and carried forward unchanged the values of all the registers except HL, which was used to carry PSHEM's return address to the bottom of the stack thus:

```
PSHEM:  EX      (SP),HL ;HL to stack
        PUSH    DE
        PUSH    BC
        PUSH    AF
        PUSH    IX
        PUSH    IY
        PUSH    HL      ;return addr
                        ;to stack

        RET
```

After some further processing, the original values of all registers, including

HL, could then be returned:

```
POPEM:  POP      HL      ;return addr
                        ;to HL

        POP      IY
        POP      IX
        POP      AF
        POP      BC
        POP      DE
        EX       (SP),HL
        RET
```

The problem was to carry HL also unchanged from PSHEM into the further processing. Though several readers noticed it in FOWIA, only Mark Restorick, a postgraduate of Salford University, pointed out that the last two instructions of PSHEM, PUSH HL and RET, could be replaced with JP (HL).

Both Tom Napier of Livingston and David Chambers of Aberdeen gave this ingenious way of combining PSHEM and POPEM in an 8080 equivalent version, requiring only one CALL to both save and restore registers, found in the Compucolor 11:

```
ISAVE:  XTHL      E3
        PUSH     D      D5
        PUSH     B      C5
        PUSH     PSW    F5
        CALL     JMPHL  CD YY YY
        POP      PSW    F1
        POP      B      C1
        POP      D      D1
        POP      H      E1
        RET       C9
JMPHL:  PCHL      E9
```

To borrow from the superb documentation of another similarly structured routine sent by Barry Philcox of Leaffield near Oxford, it is used like this:

MICROMART

Great products
from Mutek

BASIC 1 & 3

Replacement PROMs for OSI/UK101 BASIC-in-ROM

BASIC 1 allows direct entry of graphics from keyboard or cassette, adds a CALL command.

BASIC 3 fixes the string-handling 'garbage-collector' bug in the Microsoft BASIC.

£15.00 +VAT

for the pair, including documentation

1000 users can't be wrong!

CEGMON

The only full-feature monitor for all OSI and UK101 systems — now also for Superboard Series 2!

- ★ Twin-cursor screen editor ★
- ★ New screen-handler ★
- ★ Machine-code development support ★
with assembler-compatible editor,
full machine-code monitor
- ★ Disc bootstrap ★
- ★ Full compatibility ★

£29.50 +VAT

complete with full manual and reference card

8K memory/ PIA board

A professional-quality expansion board for all Superboard and UK101 systems.

- ★ 8K of reliable static memory (2114L3) ★
- ★ Two-way parallel port (6821 PIA) ★
- ★ Fully buffered — boards can be linked ★

Assembled, tested and guaranteed

£65.00 +VAT

Ribbon-cable and plugs: add £8.00 +VAT

New products

Many more products will be ready by the time this advert comes out, including new 16K RAM board, new BASIC support monitor, serial-to-parallel converter, and others. Ring for details now!

MUTEK

Quarry Hill, Box, Wilts
Tel: Bath (0225) 743289

Pick a Bargain for your 6800/6809 System!

1. CSH008 SWTPC compatible 5" floppy disk controller, bare PCB £35.00
— as above, assembled and tested with 1771 chip £140.00
2. CSH009 6800 to 6809 convertor board for 6800 CPU board, bare PCB £8.00
3. CSH010 16k STATIC RAM, uses 2114's, silk screened, bare PCB £35.00
— as above, assembled, fully socketed with 16k RAM £150.00
4. CH020 6800 chip set, 6800 6810 6820 6875 6850 — a bargain at £16.50
5. CSH021 Molex connectors, female, pack of ten £3.00
6. CSH022 Molex connectors, male, pack of ten £2.50

SWTPC Pcb's:-
Motherboard MPB/2 6800 CPU MPA/2 £11.00
£24.20 (assembled) £75.00
Serial Interface Parallel int.
MPS £6.60 MPL/A £6.60

— all the above PCB's are offered at a fraction of their original cost.

NEW! 6809 Disassembler, disassembles 6809 or 6800 code, available on FLEX 5" or 8" disk, it's DYNAMITE!!

Please add VAT at 15%, prices include postage.

COMPUSENSE LTD, PO BOX 169, Palmers Green, London N13 4HT. Tel. 01-882 0681.
— Dealers for SWTPC. Full range of software & hardware —

CARDIFF MICRO CENTRE

APPLES + PETS

+
SHARP MZ-80s

+
HEWLETT PACKARD

+
COMPUTER BOOKS

+
DEMONSTRATIONS

+
SEIKOSHA PRINTERS
ONLY £250 + VAT

SIGMA SYSTEMS

54 PARK PLACE
CARDIFF CF1 1YU

MICROMART

Timedata Limited

ZX80 Moving Graphics Games!

£4 per cassette with 2 superb games. No flicker, no fuss. S.A.E. for latest list.

The ZX80 Magic Book

Programs, programming tips, hardware notes including circuits for extension memory and I/O £4.75

Making the most of your ZX80

Tim Hartnell's superb book for all ZX80 enthusiasts £6.95

Getting Acquainted with your ZX81 (and 8K ROM ZX80)

40 programs including Draughts! £4.25

The Atom Magic Book

Hardware notes, Programs (including speech I/O), and useful ROM & RAM addresses. A must for every ATOM user. £5.50

Atom Games Cassettes

4 games on one cassette for £5. S.A.E. for list.

TIMEDATA Ltd 57 Swallowdale, Basildon, Essex.

* NEED MORE MEMORY FOR YOUR 8K SUPERBOARD/UK101?*

Look no further. We offer a 16K DYNAMIC RAM BOARD. Fully built and tested for LESS than a kit price. 16K DYNAMIC RAM BOARD ONLY £85.99

Features

- * Fully built, tested and guaranteed.
- * Includes on board power supply (uses no mother board power).
- * Price includes transformer.
- * Further expansion socket on board.
- * Pseudo-static operation (no refresh hold ups).

Orders/Enquiries

Baringwood Ltd.
Apt. 6, 56 Cameron Rd, Seven Kings,
Ilford, Essex. IG3 8LF.
Phone No. 01 599 6898.

Also available: 40 Pin DIL Jump Lead
only £5.20
4116 200ns Dynamic
Rams £1.37 ea.

Add £1.50 P/P then 15% VAT for RAM
Board. Add £0.30 P/P then 15% VAT
for all other items.

COMING SOON LOW COST 32K
RAM BOARD.

i systems Ltd.

VERY HIGH RESOLUTION FOR NASCOM 2

380 x 220 individually addressable points

FEATURES:

- * fully bit mapped from dynamic RAM
- * software controlled
- * software supplied for point-plot, line-draw, — block shading and display control
- * mixed text and graphics
- * real time plotting
- * display size variable to suit memory available

Price. . . . £55 + 15% VAT
(post free)

EPROM PROGRAMMER FEATURES:

- * programs: 3-rail: 2708, 2716 and single rail: 2758, 2508, 2716, 2516, 2732, 2532
- * EPROM type selected by plug-in modules — 3 modules supplied with simple wiring diagrams for all EPROM types
- * driven from NASCOM 1 or 2 PIO
- * powered from NASCOM and transformer supplied)
- * software supplied for READ/PROGRAM/VERIFY

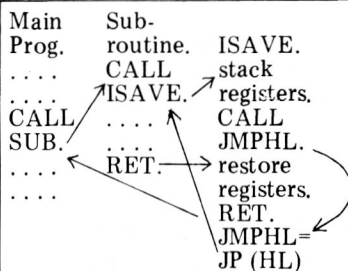
** CAN BE USED WITH OTHER MACHINES WITH 2 PARALLEL PORTS

Price. . . . £63 + 15% VAT
(post free)

Both products built & fully tested supplied with comprehensive documentation and full instructions for simple installation

Send SAF for free data sheets
AVAILABLE NOW direct from:-

6 Laleham Ave., Mill Hill London NW7 3HL
Tel: 01-959 0106



This method could be used on the Z80 and expanded to save the IX and IY registers. But, since the registers are automatically restored after the processing between the PCHL (JP (HL)) and POP PSW (POP AF) instructions, it cannot be used where the registers are needed to pass information from the

subroutine to the main program. Neither does it solve the PSHEM problem, since there is no way the original value of HL can be carried forward on a PCHL (JP (HL)) instruction.

The same solution, given in Data-sheet PUSHM, was sent by Mark Restorick and Dave (arithmetic) Barrow. This doubles the length of the original PSHEM but a routine that carries forward every register unchanged does save us from having to remember which one is altered. Paul Bloomfield of Brynston School, Blandford and Richard Steedman of Edinburgh sent correct solutions on the same lines but two bytes longer in restoring the original value into HL from the stack.

Datasheet

```

;= PUSHM — Save all registers.
; CLASS: 1
; TIME CRITICAL ? No
; DESCRIPTION: Pushes all regs, keeping their values unchanged
;               and above the return address on the stack.
; ACTION: (SP) ← HL
;          STACK ← other registers; HL; AF
;          Point HL at stack-saved H
;          A ← (HL); L ← (HL-1); H ← A
;          AF ← STACK
; SUBr DEPENDENCE: None
; INTERFACES: None
; INPUT: None
; OUTPUT: All registers on stack
; REGs USED: None
; STACK USE: 14
; LENGTH: 20
; TIME STATES: 169
; PROCESSOR: Z80

```

PUSHM:	EX	(SP),HL	; get return address in HL	E3
	PUSH	DE	; and put HL and	D5
	PUSH	BC	; all other	C5
	PUSH	AF	; registers	F5
	PUSH	IX	; and flags	DD E5
	PUSH	IY	; on stack.	FD E5
	PUSH	HL	; return address to stack head.	E5
	PUSH	AF	; save AF for local use.	F5
	LD H	HL,+15	; point HL at H	21 0F 00
	ADD	HL,SP	; on stack and	39
	LD	A,(HL)	; get in A.	7E
	DEC	HL	; point at L on stack	2B
	LD	L,(HL)	; restore to L.	6E
	LD	H,A	; restore H	67
	POP	AF	; and AF.	F1
	RET		; return.	C9

Shorter and faster, at 15 bytes and 121 t-states, but using the alternate register set we originally decided to keep for the fast interrupt service and also changing H'L', is this code sent in by both Gordon Grant of Manchester and Neil Imrie of Bedford:

```

EXX      D9
POP      HL  E1

```

```

EXX      D9
PUSH     DE  D5
PUSH     BC  C5
PUSH     AF  F5
PUSH     HL  E5
PUSH     IX  DD E5
PUSH     IY  FD E5
EXX      D9
PUSH     HL  E5

```

MAIL ORDER DISKETTES

5¼" 35 track Single sided (inc VAT) £1.95
 5¼" 35 track Double sided £2.75
 8" Single sided/Single density £1.95
 8" Double sided/Double density £2.75
 P&P 50p (orders under £20). Cheque with order (please!) Delivery by return of post. For large orders Tel: 01-388 0746

MORNINGTON MICROS LTD
 40 Mornington Crescent,
 LONDON NW1

COMPUKIT ADVENTURES

INCREDIBLE MACHINE CODE PROGRAMS FOR ALL MONITORS

1. NEW YORK SUBWAY/TROLL'S TUNNEL £5
2. ZOMBIE FOREST/VAMPIRE CASTLE £5
3. KY TEMPLE OF THE DRAGON KING £6
4. ALL ABOVE 2x8K (SUPERBOARD COMPATIBLE)
4. ALIEN ADVENTURE 16K. £6

TWO OR MORE LESS 20%
 From Mr M Perkins, 290 Station Road
 Stechford, Birmingham B33 8QR

EXX D9
RET C9

Other solutions depended on receiving a small area of RAM as a temporary store for one or more registers. While

this can be effective in private single-user environments it is not so useful for general purpose routines to be used in many different systems. One such solution from Barry Philcox, to be used like ISAVE, is given in Listing 1

```

SVALL: LD (TMPLH),HL ; save HL in RAM. 22 YY YY
        LD (TMPDE),DE ; save DE in RAM. ED 53 YY YY
        EX (SP),HL ; swap HL and return addr. E3
        PUSH DE ; save DE on stack. D5
        PUSH BC ; save BC on stack. C5
        PUSH AF ; save AF on stack. F5
        LD DE,RESTR ; put co-routine 11 YY YY
        PUSH DE ; address on stack. D5
        PUSH HL ; put return addr on stack. E5
        LD HL,(TMPLH) ; restore HL. 2A YY YY
        LD DE,(TMPDE) ; restore DE. ED 5B YY YY
        RET ; to calling subroutine. C9
RESTR: POP AF ; restore AF. F1
        POP BC ; restore BC. C1
        POP DE ; restore DE. D1
        POP HL ; restore HL. E1
        RET ; to main program. C9
TMPLH: DEFW ; two bytes for HL.
TMPDE: DEFW ; two bytes for DE.

```

Listing 1

Does this point the way to a single-call save and restore routine like ISAVE, which will carry HL forward unchanged after the registers are saved but, as in our revised PSHM, will use the stack instead of its own revised area of RAM?

Random numbers

First some improvements to April's RNDCH from Dave Barrow. Replace JP P,LOOP 3 by JR NC,LOOP3, saving one byte. Better still, the following code saves three further program bytes and two stack bytes at the expense of up to 280 or so t-states:-

```

RNDCHS: PUSH HL ; table addr.
        LD A,R ; random no.
LOOP: SUB (HL) ; table length.
        JR NC,LOOP ; get
        ADC A,(HL) ; displacement
        ADD A,L ; and add
        LD L,A ; into
        JR NC,SKIP ; table
        INC H ; address,
SKIP: LD A,(HL) ; get chr.
        POP HL
        RET

```

While adequate in the context in which it was used (selecting a character after pressing the key of the previous

randomly selected character) the routine is not as random as it might be. If the same key is used all the time to trigger the selection of a character, some keys (on the Nascom 1 anyway) result in either all odd or all even table addresses being generated, while other keys give alternate odd and even addresses.

Next, in Datasheet RAND, is a 16-bit pseudo random number generator from Gerald Evans of Merthyr Tydfil. It uses the formula $X_{i+1} = aX_i + C \text{ mod } M$ where:

$$M = 2^{*}16$$

C may be any odd number (RAND uses 41)

$$a = 1 \text{ mod } 4 \text{ (1,5,9,13 etc.)}$$

Some a's are better than others; 765, 889, 989 and 2009 being some good values. RAND uses 257, which is reasonably good and easy to multiply by. The sequence of random numbers will repeat after 65,536 numbers have been generated. Note that HL should contain the previous random number. It must therefore be seeded (the R register can be used) before the first call and saved between subsequent calls to RAND.

Datasheet

```

;= RAND - 16-bit pseudo random number generator
;/ CLASS: 1
;/ TIME CRITICAL: No
;/ DESCRIPTION: Generates a 16-bit random number from the series
                Ri+1 = Ri*257 + 41 mod 2**16
;/ ACTION: Save AF, BC
;/ Save HL
;/ HL ← HL * 256 ignoring carries
;/ HL ← HL + value off stack ignoring carry

```

SPECIALISED ELECTRONIC CIRCUITS

Do you have an idea for a circuit which you have difficulty in implementing?

We undertake all types of circuit design from initial concept through circuit diagram to completed board.



New Bungalow
Essendine Road
Ryhall
Stamford
Lincolnshire
Tel. 0945 71 2741

GAMES FOR THE PET

We believe we are the first to implement the following games on a microcomputer:

WORLD WAR III . . . £5.00

Up to eight armies fight it out over a map of the World.

A game of strategy, luck and downright nastiness.

Excellent graphics.

MATHSTREK. £5.00

Designed to teach manipulation of mathematical expressions.

A mind bending game of strategy. Full graphics.

We have completely new versions of the following old favourites:

LUNAR MODULE . . . £5.00

Can you get to the Moon and back to the space station?

Any number of degrees of difficulty. Operates in real time

mode with full graphics.

KLINGONS. £5.00

Three dimensional space battle. Are you quick enough to

dodge when they fire back?

All prices include VAT but add 25p for post and packing.

PI-LOK Systems Ltd, 313 Bury & Rochdale Old Road,
Heywood, LANCs. OL10 4BG.

MICROMART

Wida Software

SPECIALISTS IN COMPUTER ASSISTED LANGUAGE TEACHING

APFELDEUTSCH:

Complete self-tuition package in German for Apple/ITT 2020: 9 diskettes, 6 audio cassettes, workbook, textbook, Takes Beginners to Post O'Level. (Classroom version also available) Special introductory offer until July 30

Apple/ITT disks £99

GERMAN ROUTINES:

Stand-alone sets of perpetual self-testing drills and routines in German - article and adjectival endings, word order, time of day, money, etc. Fine for O'Level revision (BA Finals too!) (Selection of any four routines)

Apple/ITT disk £20

Pet Cassette £15

TEACHERS TOOLKIT:

Define and Write your own instant assessment tests - any text-based subject - with no knowledge of computing.

Apple/ITT disk £20

Pet cassette £15

MULTIPLE CHOICE TOOLKIT:

Define and Write your own multiple choice tests - any subject - using specimen provided and changing only data statements.

Apple/ITT disk £15

Pet Cassette £10

APPLEWRITER LOWER-CASE ADAPTOR

Beats Optrex! Give your e-mails a treat and insist on lower-case for Applewriter word processing on screen (and foreign character sets). Plug-in ROM (Revision 7 Applies only)

£28

Send for details to: Wida Software

2 Nicholas Gardens, London W5 5HY
(01-567 6941) or (062-882 5206)

BIG EARS

SPEECH
INPUT
FOR
YOUR
COMPUTER!



BIG EARS opens the door to direct man-machine communication. The system comprises analogue frequency separation filters, preamps and signal conversion, together with a quality microphone and extensive software.

Words, in any language, are stored as "voice-prints" by simply repeating them a few times in "learn" mode. Using keyword selection techniques, large vocabularies can be constructed.

Use BIG EARS as a front end for any application: data enquiry, robot control, starwars - the possibilities are unlimited...

BUILT, TESTED & GUARANTEED ONLY £49

PRICE INCLUDES POSTAGE & PACKING. PLEASE ADD VAT AT 15%

PLEASE STATE COMPUTER: UK101, SUPERBOARD, NASCOM2,

PET, TRS80, ETC.

MICROGRAPHICS

Colour Conversion for UK101/NASCOM 1 & 2/ Superboard. (Modulator included)

KIT £45

BUILT £60

COLOUR MODULATOR

RGB in, PAL/UHF out

KIT £12

BUILT £18

Please add VAT at 15% to all prices

Barclay/Access orders accepted on telephone

WILLIAM STUART SYSTEMS Ltd

Dower House, Billericay Road, Herongate, Brentwood, Essex CM13 3SD. Telephone: Brentwood (0277) 810244

ELECTRONIC ACCOUNTING SERVICES

SOFTWARE FOR CPM-tm SYSTEMS

Compiled with C-Basic-2 & M-Basic

and supplied on 8" IBM Standard Floppy Discs

	C-Basic*	M-Basic
1. Discounted Cash Flow: using both Yield and NPV Methods.	£100	£120

2. Fully Algebraic Programmable Calculator Simulation	£ 60	£ 75
---	------	------

Add VAT to all prices.

Write for further details to:

Electronic Accounting Services,
41, Budleigh Crescent, Welling,
Kent. DA16 1DX.
Tel No: 01-303 4468
VAT Reg No: 335 9720 40

Terms Strictly Payment with Order.

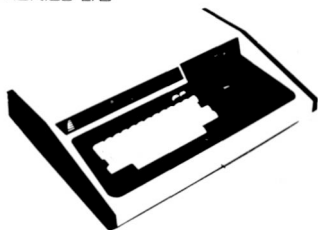
NOTE: CPM C-Basic-2 & M-Basic are all Registered Trademarks.

*Required to be a Registered User of C-Basic-2.

MICROMART

NESTRA
ELECTRONICS LTD

**MICROPROCESSOR
DESIGN ENGINEERS**



the high quality VIDEO GENIE

- * 16k ram+ 12k BASIC
- * TRS-80 level 2 software
- * Huge range of software
- * Ready to go: simply plugs into mains, and monitor or TV.
- * Fully expandable

Backed up by 12 months warranty from:

NESTRA ELECTRONICS LTD
The Tabernacle Laboratory
Bookers Lane, Earnley,
Chichester, Sussex PO20 7JG
TEL: 0243 512-861

6800 SOFTWARE

* **EDITOR ASSEMBLER** — Supports all Motorola mnemonics plus FCB, FCC, ORG, RMB, FDB. Up to 200 labels. Arithmetic expressions. Comment field. Requires 4k Ram or Rom at B000. LISTING/MANUAL £19.65

* **4K BASIC INTERPRETER** — Floating point arithmetic. 9 digit. All usual expressions, commands etc. 4k romable at C000. LISTING/MANUAL £14.50

Above Programs run under MIKBUG or Compatibles.

Send 50p for catalogue, which includes information on Basics, Disassemblers, Monitors, Games etc.

J. MORRISON (MICROS), Dept (W),
2 Glensdale Street, Leeds LS9 9JJ.
Tel. LEEDS (0532) 480987.

TERMS Strictly Cash With Order. All prices inclusive.

OK
NEW LOW PRICE

MICROLINE 80

£299*

We can also supply:

- NEC from . . . £1350*
- MX80 range from £259*
- DIP 81 £249*
- Centronics 737. £349*
- Anacom 150 . . £799*
- Base 2 £295*
- Seikosha GP80. £199*
- TVI 912C. . . £475*

NORTHAMBER LTD
Great Oak House, Esher, Surrey
KT10 9BR Tel: 0372 62071
*plus VAT and delivery

```

;/      HL ← HL + 41 ignoring carry
;/      Restore BC, AF
;/      SUBr DEPENDENCE: None
;/      INTERFACES: None
;/      INPUT:  HL contains the previous random number or,
;/              at the first call, a seeded number
;/      OUTPUT: HL contains the new random number which
;/              must be saved for the next call
;/      REG's USED: HL
;/      STACK USE: 6
;/      LENGTH: 20
;/      TIME STATES: 223
;/      PROCESSOR: Z80, 8080/85
    
```

```

RAND: PUSH AF      ; save registers      F5
       PUSH BC      ; and flags.         C5
       PUSH HL      ; stack random number. E5
       ADD HL,HL ; *2                      29
       ADD HL,HL ; *4                      29
       ADD HL,HL ; *8                      29
       ADD HL,HL ; *16                     29
       ADD HL,HL ; *32                     29
       ADD HL,HL ; *64                     29
       ADD HL,HL ; *128                    29
       ADD HL,HL ; *256                    29
       POP BC       ; old random number.   C1
       ADD HL,BC ; *257                    09
       LD BC,+41;                      01 29 00
       ADD HL,BC ; *257+41                09
       POP BC       ; restore             C1
       POP AF       ; registers and flags. F1
       RET                                           C9
    
```

LEISURE LINES

by J J Clessa

April's puzzle was very easy — we had about 200 replies, all of them correct! Several readers, hoping to increase their chances of being randomly selected, sent in multiple entries; these were detected, however, and the excess ones duly binned.

Anyway, the chosen winner was Mr A R Ashton from Knaresborough, N Yorks, who'll receive this month's prize of an exciting book token. The winning solution is 62, obtained as follows: A6, A7, B1, D2, F6, F7, G4, H1 (labelling the rows A-H and the columns 1-8).

Quickie

As usual, no prizes, so no answers required. Rearrange the following letters to form one word: NEW DOOR.

Prize puzzle

Another one to bust your micros, if

there are any left after last month's puzzle.

1) Find the largest prime number which, when its digits are translated into characters, gives an English word.

2) Translate as follows:

0 = R	5 = N
1 = D	6 = I
2 = A	7 = S
3 = G	8 = T
4 = B	9 = E

3) The word must be an entry, or the derivative of an entry, in the *Concise Oxford Dictionary*, Fifth Edition (not the appendices); no foreign words or proper nouns are permitted.

Send your answer on a postcard, including both the number and the word, to Puzzle 23, PCW, 14 Rathbone Place, London W1P 1DE, to arrive no later than 31 August. This month's prize will be a copy of the aforementioned dictionary!

ZX81 ZX80 ACORN ATOM!

The monthly magazine INTER-FACE gives you a number of ready-to-run programs for each computer in each issue, plus a host of hints and tips. Large s.a.e. for free copy.

INTERFACE 44 Earls Court Road,
London, W8 6EJ

COMPASS

6 Market Street,
Standish,
Lancs, WN6 0SQ



Start your computer hobby with an inexpensive **SUPERBOARD 3** or **CHALLENGER CIP**, and expand later.

* Full range of Software and Add-ons*
S.A.E. or call in for our new catalogue detailing our **SPECIAL OFFERS** (limited period)

PROGRAMS

ZX80 Sliding letters

by B Cope

Here is the computer version of the game where you slide interlocking lettered tiles around on a 4 x 4 board until they are all in alphabetical order.

Enter this program and press RUN. There are three degrees of difficulty — so try the easy one first. A randomly generated board will be displayed with one blank tile.

Type in the letter that you wish to slide into the blank position. Illegal requests will be ignored. A correct board with the blank in the lower right corner will be acknowledged, and another turn offered.

If you give up during the game, enter 99. The program runs in 1k.

```

10 RANDOMISE
20 DIM A(35)
30 FOR B = 0 TO 35
40 LET A(B) = -1
50 NEXT B
60 FOR B = 1 TO 4
70 FOR C = 1 TO 4
80 LET A(6*B+C) = 33+4*B+C
90 NEXT C
100 NEXT B
110 LET B = 28
120 LET A(B) = 0
130 PRINT "1=EASY 2=NORMAL 3=HARD"
140 INPUT F
150 LET F = 200 + 150*(F=2) + 180*(F=1)
160 LET C = 0
170 LET D = RND(4)
180 LET E = (D=1)-(D=2)+6*(D=3)-6*(D=4)
190 IF A(B+E) < 0 THEN GO TO 170
200 LET A(B) = A(B+E)
210 LET A(B+E) = 0
220 LET C = C+1
230 IF C = F THEN GO TO 410
240 LET B = B+E
250 GO TO 170
260 CLS
270 PRINT "MOVE";E
280 LET D = 0
290 FOR B = 1 TO 4
300 PRINT
310 FOR C = 1 TO 4
320 PRINT CHR$(A(6*B+C));" "
330 IF A(6*B+C)=33+4*B+C THEN LET D=D+1
340 NEXT C
350 PRINT
360 PRINT
370 NEXT B
380 IF D = 15 AND A(28) = 0 THEN GO TO 550
390 PRINT "LETTER PLEASE?"
400 RETURN
410 LET E = 0
420 GOSUB 260
430 INPUT A$
440 IF A$ = "99" THEN STOP
450 FOR B = 7 TO 28
460 IF A(B) = CODE(A$) THEN LET C = B
470 IF A(B) = 0 THEN LET D = B
480 NEXT B
    
```

MICROMART

MULTITEXT for the ZX80

Businessmen, Teachers, Restaurateurs,
Foreign language speakers, Party-givers!

MULTITEXT for 4k, 8k or 16k RAM enables you to print text in 9 different styles, including 3 different sizes. Displays may be SAVED on tape for subsequent reprinting. 16k version also features lower case letters (large and medium sizes), facilities for printing your firm's logo or a simple diagram (up to 24 x 16 pixels resolution); special characters (mathematical symbols, accented vowels, etc.); even alternative alphabets (Greek, Hebrew, Cyrillic) may be printed (details on request). All versions supplied on C12 cassette. 4k and 8k versions include 12pp technical manual. 16k version prints instructions and prompts on screen.

MULTITEXT (please specify 4k, 8k 16k) . . . £7.00

ALSO 1k GRAPHICS PACKAGE (cassette

+ 12pp manual) . . . £8.00

GRAPHICS manual only (includes technical notes) . . . £3.00

1k Audio MORSE SIGNALLER (cassette + 3pp manual) £3.50

1k GAMES PACKAGE (cassette + 6pp manual) . . . £5.00

GAMES manual only (6pp, 3 games + technical notes) . . . £2.00

SPECIAL OFFER (all progs on 3 cassettes + manuals) . . . £19.95

BRIDGE SOFTWARE (W), 36 Fernwood,
Marple Bridge, STOCKPORT, Chs SK6 5BE
(Mail Order Only)

— inland postage and packing free —
— send S.A.E. for details —

ZX81 programs available soon

PET COMPUTERS

Southampton

FREE with any Commodore Computer
TOOLKIT (value £35) and Dustcover (£4)

Price List	
2001S (16K)	£425
4008N	£420
4016N	£495
4032N	£595

4040 Disk Unit £460

inc FREE box disks

4022 Printer £355

in inc FREE box paper

Tensai Cassette Deck (sound and counter)

£70

HIRE Commodore equipment by the week

8K £23 32K £30 Disk, Printer £30

Nearly NEW ex-hire and demo machines

available eg 16K £450 32K £500 with

TOOLKIT

See the new VIC 20 on display

6550 RAMs £10 each

SHARP PC1211 Computer £78.00

CE121 Cassette Interface £12.00

All prices are cash-and-carry and exclude

VAT

OFFICIAL COMMODORE DEALER

SUPER-VISION

13 St James Road, Shirley, Southampton

Telephone (0703) 774023

After hours (0703) 554488

topmark computers

NEW! NEW! NEW!



APPLE FORTRAN
(Needs language card)

Send only £120 + VAT £18 (Fortran only)
or £419 + VAT £62.85 (complete
system, includes Pascal and language card)

NEW! NEW! NEW!

NEW! DOS 3.3 — much improved
capacity £40 + VAT £6.

NEW! Eurocolour card — vastly
superior to previous versions £113 + VAT
£16.95

Official Government and Educational
orders accepted.

Contact Tom Piercy at
Topmark Computers, 77 Wilkinson Close,
Eaton Socon, St Neots, Cambs. PE19 3HJ
Huntingdon (0480) 212563

STOKE on TRENT

for
TUSCAN
and
TANGERINE
and
VIDEO GENIE + SOFTWARE
and
BOOKS

MICRO-PRINT Ltd.,
59, Church Street, Stoke on Trent.
(0782) 48348. Barclaycard and Access

MICROCOMPUTER APPLICATION & PROGRAMMING COURSES

Discover a new world by attending ASK Microcomputer Programming Courses. Learn how to apply the new technology of the Micro revolution to your business or career, including writing your own programs and running them on a choice of microcomputers and peripherals. Write or telephone for Brochure.

ask
...for the answers

Ask Systems Limited
19-27 Kents Hill Road,
Benfleet, Essex SS7 5PN
Tel: S. Benfleet (03745) 2644

North Star

(all prices exclude VAT/carriage)

Horizon Computers (32k 20/D Drives)£1790
Extra 16k RAM (bank select)£230
F/P Arith. Board£205
TVI - 912C VDU£587
NEC Spinwriter (with tractors)£1390
CPM V2.2£90
WordStar V2.2£170
DataStar£140
Full range S-100 by N/Star, Morrow Designs; SSM, plus
Lifeboat Associates software - eg. Microsoft, Digital
Research etc. available.

ALSO Apple goods, viz:
Microsoft Z80 Softcard (CP/M,M/S.Bas)£173.
Microsoft 16K RAM Expansion Card.£105
For full details of above and other items contact:

S-SYSTEMS

9 Goffs Close, Crawley, Sussex
Tel: Crawley 515201

PET MACHINE LANGUAGE GUIDE

IF YOU ARE INTERESTED IN OR ARE
ALREADY INTO MACHINE LANGUAGE
PROGRAMMING ON THE PET, THEN
THIS INVALUABLE GUIDE IS FOR YOU.
MORE THAN 30 OF THE PET'S BUILT-IN
ROUTINES ARE FULLY DETAILED SO
THAT THE READER CAN IMMEDIATE-
LY PUT THEM TO GOOD USE. £5.50

THE BRAIN SURGEON (Apple)

This Diagnostic's package is designed to check
every major area of your computer, detect errors
and report any malfunctions. The Brain Surgeon
will put your system through exhaustive, thorough
procedures testing and reporting all findings. £30.00
RS232 Serial Interface. £50.00
Apple Serial I/O. £45.00
PET TV Interface £35.00
PET Soundbox. £22.50
Disk Head Cleaning Kit £17.50
PET IEEE/Parallel Interface (addressable). £80.00
4-channel A/D Converter. £45.00
8-channel programmable Relay Switching Unit
£45.00

UART & BAUDRATE Generator £50.00
(converts parallel to serial and serial to parallel)

Apple Action Adventure Games

RED BARRON £14.95 BATTLE OF MIDWAY
SUB ATTACK £14.95 £14.95

Mail order welcome. Please send for catalogue.

PEDRO COMPUTER SERVICES

65 Glebe Crescent
Kenton, Middx. HA3 9LB
Tel. 01-204 9351

ADP USED TELETYPE ASR 33's



V24 INTERFACES ARE STANDARD
ALL UNITS CARRY 30 DAY
RETURN-TO-DEPOT WARRANTY
£200+ VAT

(QUANTITY DISCOUNTS AVAILABLE)

Call or Write to Chris Turner
ADP Network Services Ltd.
179-193 Great Portland Street
London W1. Tele: 01-637 1355

PROGRAMS

- 490 LET B = C - D
- 500 IF NOT(ABS(B)=1 OR ABS(B)=6) THEN GO TO 430
- 510 LET A(D) = A(C)
- 520 LET A(C) = 0
- 530 LET E = E + 1
- 540 GOTO 420
- 550 PRINT "WELL DONE"
- 560 RUN

UK101 Car Rally

by Martin Stiby

Steer the car through the well littered
race track.

- 40 G9=INT(RND(1)*100+100)
- 49 FORT=1T016:PRINT:NEXT
- 50 GOSUB3000
- 65 POKE54221,32:S=64:D=53565:M=53586:Z3=53340
- 80 N=53984:F=18:U=53728:POKEU,18
- 90 POKE11,34:POKE12,2:POKE530,1:K=57088:POKEK,127
- 95 P1=127:P2=191:P3=32:P4=179:P5=1:P6=,5:P7=8:P8=40
- 99 REM movement routines
- 100 P=PEEK(K)
- 110 IFP=P1ANDU)MTHENPOKEU,P3:U=U-S
- 120 IFP=P2ANDU)NTHENPOKEU,P3:U=U+S
- 130 IFPEEK(U)=P4THENGOSUB1000
- 200 X=USR(X):POKEU-P5,P3
- 205 IFPEEK(U)=P4THENGOSUB1000
- 220 POKEU,F
- 300 IFRND(P5)(P6GOTO600
- 400 I=S*INT(RND(P5)*P7)
- 410 POKED+I,P4
- 600 Q=Q+P5:Z=Z+P5
- 620 IFQ)G9THENZ=Z+P5:GOTO100
- 640 FORT=P5TOP8:NEXT
- 998 GOTO100
- 999 REM crash routines & score
- 1000 H=H+1:D=0
- 1005 POKEU-P5,P3
- 1020 FORT=1T010
- 1030 FORT1=16T023
- 1040 POKEU,T1
- 1050 FORT2=1T010
- 1060 NEXTT2,T1,T
- 1070 POKEU,18
- 1075 IFH=5THEN2000
- 1080 POKEZ3-1,83:POKEZ3-2,73
- 1090 POKEZ3-4,69:POKEZ3-5,82:POKEZ3-6,79
- 1095 POKEZ3-7,67:POKEZ3-8,83
- 1100 Z#=STR\$(Z):Z1=LEN(Z#)
- 1120 FORZ2=Z3TOZ3+Z1-P5:Z4=Z4+P5
- 1140 POKEZ2,ASC(MID\$(Z#,Z4,P5)):NEXT:Z4=0
- 1170 FORT=1T05000:NEXT
- 1180 G9=INT(RND(1)*100+100)
- 1200 FORZ2=Z3-P7TOZ3+Z1-P5:POKEZ2,P3:NEXT
- 1300 FORT=1T03000:NEXT
- 1998 RETURN
- 1999 REM final score & end
- 2000 FORT=1T016:PRINT:NEXT

PRICES SLASHED

As our introductory offer the following
prices are held firm until 31 August
£40 off VISICALC Now £85
£20 off DESKTOP PLAN Now £55
£15 off PASCAL CARD Now £284
Games Software. From £8
Educational Software. From £10
Business Software. From £90
Add 15% VAT and £1 p&p to above
prices. For full catalog send to:
ANDERLEE COMPUTING SERVICES,
17 ADELPHI CRES, HAYES PARK,
HAYES, MIDDX UB4 8LY
or telephone 01-841 1507

CHEAP PETS

3032 Computer £550.00
3040 Disk Drive £550.00
4040 Disk Drive £550.00

Tel: Rickmansworth 71306

PROGRAMS

```

2010 POKE530,0:POKE518,255
2020 PRINT" YOUR FINAL SCORE IS";Z
2030 PRINT:PRINT:PRINT
2040 PRINT"Do you want another go";
2045 POKE518,0:INPUTA$
2050 FOR T=1 TO LEN(A$): IF MID$(A$,T,1)="Y" THEN RUN
2060 NEXT
2070 FOR T=1 TO 16: PRINT: NEXT
2090 END
2999 REM code for car movement & instructions
3000 DATA 162,1,189,0,210,157,255,209,169,32
3010 DATA 157,0,210,189,0,209,157,255,208,169
3020 DATA 32,157,0,209,237,208,231,169,32,141
3030 DATA 12,209,141,76,209,141,140,209,141
3040 DATA 204,209,141,32,210,141,76,210,141
3050 DATA 140,210,141,204,210,96
3100 FOR T=546 TO 599: READ T1:POKE T,T1: NEXT
3200 INPUT"Do you need instructions";A$
3210 FOR T=1 TO LEN(A$): IF MID$(A$,T,1)="Y" THEN 3300
3220 NEXT
3230 GOTO 3600
3300 PRINT TAB(15) "CAR RALLY"
3310 PRINT
3320 PRINT" You have to work your way through the cars"
3330 PRINT" You are over-taking, without hitting them."
3340 PRINT" After the 5th time you crash the game
will end"
3355 PRINT
3360 PRINT TAB(13) "CONTROLS ARE : "
3370 PRINT" £ 1 Move up"
3380 PRINT" £ 2 Move down"
3390 PRINT
3400 PRINT" W A R N I N G ! ! ! !....."
3410 PRINT" Your car will accelerate some time during"
3420 PRINT" each part of the race.....so watch out !"
3440 PRINT
3500 POKE 11,0:POKE 12,255
3510 PRINT"Get your crash helmet on and press any key."
3520 X=USR(X)
3600 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
3610 PRINT" - - - - -"
3620 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
3630 PRINT" - - - - -"
3640 PRINT:PRINT
3998 RETURN

```

TRS-80 Calendar

by J E Barker

This program provides calendar details for any year from 1753 to 4902. It says 1582 onwards in the listing but that does not apply to Britain.

```

10 'CALENDAR:- BY J.E. BARKER
11 'FOR TRS-80 LEVEL 11
12 '1 JANUARY 1981
30 CLEAR: S$="*****" : C$="*****" : C$=PRINT CHR$(23)
40 PRINT: ***** C A L E N D A R *****
50 PRINT:PRINT"THIS PROGRAMME WILL CALCULATE
60 PRINT" A CALENDAR FOR ANY YEAR
70 PRINT" FROM 1582 TO 4902 INC.
80 PRINT
90 INPUT"TYPE IN YEAR REQUIRED, THEN PRESS ENTER, "; Y
100 IF Y ( ) INT (Y) OR Y(1582 OR Y)4902 THEN PRINT:PRINT Y;"IS OUT OF RANGE": FO
R X=1 TO 1000: NEXT: GOTO 30
110 PRINT:PRINT"TO SEE A PARTICULAR MONTH ENTER

```

ZX80-81 SOFTWARE

Many games, Educational and Utility programs available for ZX80 and ZX81.

"ZX80-BASIC", as reviewed by Sync, a disassembled listing of the 4K BASIC, with Hex, Assembly, Cross reference table and annotations NOW only £7.00

ZXBUG - a machine code debugging program, runs in 4k or 16k; it allows you to, set registers, set Quit points in machine code programs, run programs, display only 64 bytes in Hex or characters, display registers, search for byte or word, copy a block of memory, set a block of memory to any value. Utilises INICEV\$ and scrolls screen even on ZX81

New low price £500

Other programs include, Startrek, Sword of Peace, Mega - Wumpas and many more!

Send SAE for latest catalogue, or orders to:

ARTIC COMPUTING
396, James Reckitt Ave, Hull, HU8 0JA

ZX81 MINI INVADERS

ALL THE THRILLS OF ITS BIG BROTHER ON A 24x16 DISPLAY ALL IN 1K RAM. £5 for M/C CODE CASSETTE

ALSO TV GAMES (4K)
ZX80/81 INVADERS
ZX80/81 GALAXY WARS

m/c code routines with continuous non-flicker display & fast moving graphics £5 each listing or SAE for details
J EDMONDS, 29 Chestnut Ave. Grays, Essex

MICROMART

sinclair ZX81 SOFTWARE

16K ADVENTURE DRUAGHTS
OTHELLO HEXAPAWN
LUNAR LAND TORPEDO
ARCADE GAMES GRAPHICS

Send a large sae for the new range of 1K and 16K software for the SINCLAIR ZX81

CDS MICRO SYSTEMS
10 Westfield Close, Tickhill
Doncaster DN11 9LA
Mail Order Only

ZX80-81

LEARN QUICKLY WITH
PROGRAM INTERCHANGE CLUB

£1.00 tape and 50p manuscript exchange. Increase your program library fast, by joining P.I.C. Tape or manuscript program interchange service - programming aids - binders - indexes - free competitions for Club members.

Send cheque/postal order £5.00 annual membership - rules - full details and free samples - payable to:-

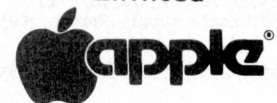
PROGRAM INTERCHANGE CLUB



2 NEWTOWN
CHICHESTER
WEST SUSSEX PO19 1UG
DEPT 092

WESTERN

Western Computers
Limited



BUSINESS SOFTWARE FOR APPLE

PAYROLL (UP TO 300 EMP)
PURCHASE LEDGER
NOMINAL LEDGER
STOCK CONTROL
SALES LEDGER
INVOICING
HARDWARE FOR APPLE

FULL BUSINESS SYSTEM FOR UNDER £2495.00

PLEASE CONTACT US FOR DETAILS

Blackpool Airport,
Blackpool, Lancs.

Phone Blackpool 404676/42660

Superboard / UK 101 Low Cost Add-Ons

ALL PRICES INCLUDE VAT & POST

8K RAM + 16K EPROM board, fully buffered and decoded. Top quality PCB—40 pin DIP connector. All memory bank selectable in 4K blocks anywhere in memory. Includes 4K 300ns RAM (2114). Full instructions etc. supplied.

Kit £48.99 built and tested £56.99

High speed cassette interface kit, 300/2400/4800/switchable to suit recorder.

Easy to fit kit £16.90

Enhanced Video Display. True 48 x 32 Display Full kit and instructions £15.95

Software for all Superboard/UK101 screen formats.
Chess 1.9 £7.90, Draughts £3.50.

Superboard II Series II fully built tested and guaranteed. £139.99.

NORTHERN MICRO Tel. Holmfirth
29 Moorcroft Park (048489) 2062
New Mill S.A.E. for list please
HUDDERSFIELD Callers welcome by appt.



goes ACORN ATOM

QUALITY PROGRAMS NOW AVAILABLE
(* Lower test area)

INVASION FORCE (5K* + 6K graphics) 4 invader types + Mother ship — 6 skill levels-increasing difficulty. Hi-score	£8.95
STAR TREK (5K* + floating point) 8x8 galaxy, starbases, torpedoes etc	£6.95
DISASSEMBLER (3K*) Lists object code & assembler mnemonics	£6.95
DEMON DUNGEON (5K*) Find the treasure, the way out & escape the demons.	£6.95
SKETCH PAD (3K*) Draw in black & white or vice versa. Save & recover routines	£6.95
LIFE (4K*) Fascinating patterns generated. Amend option	£5.95
3D NOUGHTS AND CROSSES (4K*) Play the computer. 4x4x4 matrix. 5 skill levels	£5.95
BREAKAWAY (3K*) 20 ball speeds. 5 bat sizes. High score feature	£4.95
REACTION RACE (2K*) Testing 2 player race. Times & scores given	£4.95
WRITTEN ANY PROGRAMS? WE PAY HANDSOME ROYALTIES! Please add 55p p&p/order + VAT @ 15%	
PROGRAM POWER 5 Wensley Road, Leeds LS7 2LX Telephone: (0532) 683186	

µHex EPROM PROGRAMMERS

426 2508/2708/2758/2516/2716
Dual and Single supply Eproms, £95

416 2704/2708/2716 Dual only. £65

480 2704/2708 Kit £35. Built £40.

All programmers require only standard power supplies.
The 426 & 416 are cased and have push-button selection.
Program any length block into the Eprom.
Software included. Range covers 280, 8080, 6800 and 6500. State machine.

PIO, PIA INTERFACE MODULES
Available for 280/8080 and 6800/6500.

Prices include carriage. Please add VAT
SAE for further product information.

MICROHEX COMPUTERS

UNION STREET, TROWBRIDGE, WILTS.

PROGRAMS

```

120 PRINT"MONTH NUMBER. (I.E. 1 TO 12)
130 PRINT"OTHERWISE PRESS ENTER FOR THE COMPLETE YEAR.;"
140 INPUT K: IF K=0 THEN 160
150 IF K < 0 THEN 12: THEN CLS:PRINT CHR$(23): PRINT:PRINT"WHAT? ---"K:"M
ONTHS IN A YEAR.:"PRINT" WAKE UP." :GOTO 140
160 CLS
170 *** FIND DAY OF WEEK OF JANUARY 1ST ***
180 Y1=INT((Y-1)/100)
190 Y2=Y-1-100 * Y1
200 Y3=Y
210 *** THIS IS ZELLERS CONGRUENCE ***
220 D=799+Y2+INT(Y2/4)+INT(Y1/4)-2*Y1
230 D=-((D-INT(D/7)+7))
240 L=0
250 *** CHECK FOR LEAP YEAR ***
260 IF((INT(Y/4)+4) < 0) THEN 350
270 IF((INT(Y/400)+400)=Y) THEN 290
280 IF((INT(Y/100)+100)=Y) THEN 350
290 L=1
300 PRINTCHR$(23)
310 FOR T=1 TO 50
320 IF L=1 AND Y(1981) THEN PRINTA448.Y:"WAS A LEAP YEAR."
330 IF L=1 AND Y(1981) THEN PRINTA448.Y:"WILL BE A LEAP YEAR."
350 NEXT T: CLS
360 FOR N=1 TO 12:PRINT:PRINT
370 READ A$,M
380 DATA "JANUARY",31,"FEBRUARY",28,"MARCH",31
390 DATA "APRIL",30,"MAY",31,"JUNE",30
400 DATA "JULY",31,"AUGUST",31,"SEPTEMBER",30
410 DATA "OCTOBER",31,"NOVEMBER",30,"DECEMBER",31
420 IF K=0 THEN 440
430 IF N < K THEN 470
440 CLS:PRINTTAB(4)S$:A$:S$
450 PRINT" SUN MON TUE WED THU FRI SAT"
460 PRINTTAB(4)S$: "----":Y: "----":S$
470 IF N < 2 THEN 490
480 M=M+L
490 FOR I=1 TO 6:PRINT
500 FOR J=1 TO 7
510 D=D+1
520 IF D > M THEN 610
530 IF D <= 0 THEN 570
540 IF K < 4 AND K=N THEN PRINT@270,"ALMOST THERE;"
550 IF N < K THEN PRINTCHR$(23):PRINT@200,"A FEW MOMENTS PLEASE "":GOTO 570
560 PRINTTAB(J+8)D:
570 NEXT J
580 J=1
590 IF D=M THEN 610
600 NEXT I
610 D=1-J
620 IF N=12 AND K=0 THEN 710
630 IF K=0 THEN 660
640 IF N < K THEN NEXT N
650 IF N=12 OR N=K THEN 710
660 PRINT:PRINT:PRINT:PRINT:PRINT"PRESS -- N -- FOR NEXT MONTH, OR -- C -- TO CA
NCEL.;"
670 Z$=INKEY$:IF Z$="C" THEN 740ELSE 680
680 IF Z$="N" THEN 690ELSE 670
690 CLS: K=0
700 NEXT N
710 K=0:PRINT:PRINT:PRINT:PRINT:PRINT"FOR ANOTHER YEAR PRESS ENTER. FOR ANOTHER
MONTH IN":Y3
720 INPUT"ENTER MONTH NUMBER (I.E. 1 TO 12):"K
730 IF K=0 THEN 740 ELSE RESTORE:CLS:GOTO 150
740 RESTORE: GOTO 30

```

UK101 Machine Language to Basic Converter

by J G Patton

Have you got a machine code routine that you'd like to save and load simply? Use this program to convert the code into Basic DATA statements and to

attach a small loader to make it easy to reload. A sample run follows the program listing.

```

5 REM MACHINE LANGUAGE TO BASIC LOADER TAPE CONVERSION PROGRAM
7 REM FOR OSI SUPERBOARD II
10 REM WRITTEN BY EAMONN J.G. PATTON -JAN '81
20 REM SL=CURRENT LINE NO.
25 REM SA=START ADDRESS OF MACHINE CODE PROGRAM
30 REM EA=END ADDRESS OF SAME

```

FORTH

A new compiler for NASCOM I/II or any Z80 based micro. FORTH is a structured high level language which runs over 10 times faster than BASIC.

- Runs in under 8K
 - Supplied on cassette with full documentation
 - Nascom users please quote NAS-SYS or NASBUG Price — £25
- Send SAE for further information to: Mr A F T Winfield,
148 Goddard Avenue, Hull HU5 2BP

ALGOL-60

Z80 — CP/M, PDP11, PDP8

A family of high level languages from RHA (Minisystems) Ltd. ALGOL-60, the language from which PASCAL is derived. A mature implementation with comprehensive operating system and machine code interfaces.

SYSTEM-ALGOL, the subset of Algol-60 in which all the compilers are written. Compiled code is shorter, execution faster.

Z80 based CP/M systems including TRS80

RML Algol-60, including the option of 32 bit integers instead of floating point. About 7 times faster than TRS80 Level II BASIC, speed comparable with Microsoft Fortran. Document £10, system £99 + VAT. System-Algol £50 + VAT, free leaflet.

PDP11 WITH RT-11, RSTS, RSX or IAS and PDP8 with OS/8 or stand alone

Complete package including both compilers in machine readable source form. . . £250 + VAT. The author of the compilers is available as a consultant.

83, Gidley Way, Horspath, Oxford OX9 1TQ (08677) 3625

PROGRAMS

```

35 REM ARRAY A$ CONTAINS BASIC KEY WORDS
40 REM V=FLAG IF VECTOR TO BE SET(-1=TRUE)
45 REM T=LOOP VARIABLE
50 REM A$=GENERAL INPUT STRING VARIABLE
55 REM Q$=TEMP. STRING VARIABLE
60 REM V1-V4&V6 USED AS TEMP VARIABLES IN HEX-DEC CONVERSION
65 REM VH CONTAINS HIGH BYTE OF VECTOR
70 REM VL CONTAINS LOW BYTE OF VECTOR
75 REM VB CONTAINS ADDRESS OF VECTOR LOW BYTE
80 REM LINES 100-160 INPUT DATA ABOUT M/C PROG
81 REM LINES 170-180 SET UP ARRAY WITH KEYWORDS
82 REM LINES 190-360 SAVE ON TAPE
83 REM LINES 5000-5005 INCREMENT LINE NO. AND CHECK NOT TOO HIGH
84 REM LINES 10000-10130 GET VECTOR & SPLIT TO HIGH&LOW BYTE
85 REM LINES 20000-20020 ERROR ROUTINE IF LINE NO. TOO HIGH(BIG PROG!)
100 INPUT"START ADDRESS";SA:REMSTART ADDRESS
105 SA=INT(SA)
110 IFSA(ODRSA)2*16THEN100
120 INPUT"END ADDRESS";EA
125 EA=INT(EA)
130 IFEA(ODREA)=SADREA2*16THEN100
140 INPUT"IS THERE A VECTOR TO SET";A$
150 IFLEFT$(A$,1)="Y"THENGOSUB10000:V=-1:REMGETVECTORVFLAG=-1IFTRUE
160 INPUT"STARTLINE NO.";SL:IFSL<30000ORSL(ODRSL())INT(SL)THEN160
161 REM HIGHEST LINE NO. IN BASIC IS 63999
170 DIMA$(7):FORT=0T07:READA$(T):NEXT
171 REM READ IN 'PROGRAM STATEMENTS'
180 DATA"DATA",",","FORX=","TO","READA","POKEA","NEXT","POKE"
190 POKE11,0:POKE12,253:PRINT"PRESS PLAY AND RECORD AND HIT A":
191 POKE15,255:PRINT" KEY WHEN READY":X=USR(X)
195 REM JUMP TO MONITOR SUBROUTINE WHICH WAITS UNTIL KEY PRESSED
199 PRINT:PRINT
200 SAVE:POKE15,72:REM SET THE SAVE MODE AND TERMINAL WIDTH
201 PRINTCHR$(64):PRINT:REM CLEAR NOISE CHARACTERS
205 GOSUB5000:REMNEWLINE0.
210 FORT=SAT0EA
220 V1=PEEK(T)
230 PRINTV1;
240 IFPEEK(14)>65ANDT<EATHENPRINT:GOSUB5000:GOTO250
241 REM NEAR END OF LINE
244 IFT=EATHEN250
245 PRINTA$(1);
250 NEXTT
270 PRINT
280 SL=SL+10:IFSL>63999THEN20000
290 PRINTSL:A$(2);SA:A$(3);EA
295 SL=SL+10:IFSL>63999THEN20000
300 PRINT:PRINTSL:A$(4);":":A$(5)
305 SL=SL+10:IFSL>63999THEN20000
310 PRINT:PRINTSL:A$(6)
320 IFVTHEN340
330 POKE517,0:END
340 SL=SL+10:IFSL>63999THEN20000
350 PRINTSL:A$(7);VB:A$(1);VL;":":A$(7);VB+1:A$(1);VH
360 POKE517,0:END
5000 PRINTSL:A$(0);:SL=SL+10:IFSL>63999THEN20000
5005 RETURN
10000 INPUT"VECTOR-IN HEX";A$
10004 REM ERROR CHECK
10005 IFLEN(A$)<4THEN10000
10007 FORV6=1T04:Q$=MID$(A$,V6,1)
10008 IF(Q$)="0"ANDQ$<="9"OR(Q$)="A"ANDQ$<="F"THEN10010
10009 GOTO10000
10010 NEXTV6
10015 IFLEFT$(A$,1)"9"THENV1=9+ASC(LEFT$(A$,1))-64:GOTO10030
10020 V1=VAL(LEFT$(A$,1))
10030 IFMID$(A$,2,1)"9"THENV2=9+ASC(MID$(A$,2,1))-64:GOTO10050
10040 V2=VAL(MID$(A$,2,1))
10050 VH=16*V1+V2
10060 IFMID$(A$,3,1)"9"THENV3=9+ASC(MID$(A$,3,1))-64:GOTO10080
10070 V3=VAL(MID$(A$,3,1))
10080 IFMID$(A$,4,1)"9"THENV4=9+ASC(MID$(A$,4,1))-64:GOTO10100
10090 V4=VAL(MID$(A$,4,1))
10100 VL=16*V3+V4
10110 INPUT"ADDRESS OF VECTOR LOW BYTE IN DEC,";VB
10120 IFVB(ODRVB)2*16ORVB<INT(VB)THEN10110
10130 RETURN

```

GAMER

SHARP MZ-80 (£449 + VAT for 48K)
VIDEO GENIE (£289 + VAT for 16K)
ACORN ATOM ASSEMBLED (£150 + VAT)

+ INTELVISION + ACE TV GAMES
+ CHESS COMPUTERS
+ HAND HELD ELECTRONIC GAMES
+ SF, FANTASY & WAR GAMES
+ ALL KINDS OF GAMES & PUZZLES

18 SYDNEY STREET
BRIGHTON 0273 698424

BUSINESS & COMPUTER SERVICES

Microcomputer Consultants

(TRS 80 Specialists)

Tel 01 607 0157
292 Caledonian Rd
London N1 1BA

MICROMART

Super
Machine
Code
Word
Processor
£35 + VAT



All you'd expect in a £75-£150 program, PLUS redefine keyboard, auto repeat, tape or disk files, old & new ROMs, PET or ASCII printer, AND 80-column PETS. No need to change when you upgrade. We didn't believe it either! £35 tape can be saved to disk, has 80-column mod listing. £37 disk includes sample files plus full 80-column version.

LIGHT PEN + SOFTWARE — plugs in. £22

PROGRAMMER'S TOOLKIT — 16/32K new ROM: makes programming less like work! £29

ADVENTURE 1 & 2: authentic Scott Adams 24K classic games. Each £7 (both, £13)

FANTASTIC MUSIC MACHINE: hardware + software to write music on your PET and see it play. Add small speaker or play through hi-fi. 4 voices. Transpose, change tempo, repeat segments etc just by typing a row of characters. Save music to disk or tape. Beautifully simple: write tunes within minutes! Old & new ROMs. 8-32K. £37 complete.

Add VAT to all prices please, but post/insurance included. Unconditional Instant Refund Guarantee on hardware, also software if not up to description. Write for more details, more items.

SIMPLE SOFTWARE LTD
15 HAVELOCK ROAD
BRIGHTON, SUSSEX BN1 6GL
(0273) 504879



To advertise in
MICROMART
Please ring Jacquie Hancock
on 01-631 1682

S Software for TRS80® (and Video Genie)

WE'VE BEEN GENIEFIED!

All programs now adapted for Video Genie (non-disk). Send for list.



EDIT Full-Screen BASIC Editor £17.50
EXEC DOS Command Programmer £ 9.50
ACCEL2 BASIC Compiler £39.95

ACCEL2 now further enhanced! Faster compile, less code expansion, better ease-of-use, better program chaining, TRSDOS, NEWDOS, NEWDOS 80, etc.

SOUTHERN SOFTWARE, P.O. Box 39
Eastleigh, Hants. SO5 5WG

MICROMART

VETS FOR PETS

Anita Electronic Services (London) Ltd. are specialists in the repair and service of Commodore Pets.

We offer a fast on-site service, or alternatively repairs can be carried out at our workshops should you wish to bring in your Pet.

Pet maintenance contracts are available at very competitive prices. Trade inquiries welcomed.

For further information, tel or write to:

John Meade
Anita Electronic Services
15 Clerkenwell Close, London EC1
01-253 2444

We also specialise in the repair of all makes of office equipment.



NASCOM 1 & 2

*** NEW LOW PRICES ***

Lunar Lander Supreme (16K/B/G)	£9.95
Startrek II (32K/B/G)	£9.95
Nascount Personal Finance (16K/MC)	£9.95
Invasion Earth (MC/G)	£8.95
Alien Labyrinth (16K/B/G)	£6.95
Club Membership (32K/B)	£9.95
WIRRAL PILOT V4.0	£12.50
Super Life (MC/G)	£6.95
Music Box (16K/B/G)	£9.95
Cowboy Shoot-out (MC/G)	£4.95
WORDEASE - Word Processor	£25.00

Please add 55p/order P & P

+ 15% VAT PROGRAM

POWER, 5 Wensley Road,

Leeds LS7 2LX

or send Sae for FULL

catalogue. Tel (0532) 683186

* NOW -

ACORN ATOM CATALOGUE - Send Sae

It pays to increase your

PET POWER

Why not make use of the spare ROM sockets in your large keyboard PET or CBM machine? Let's take a look at some of the options:

SUPERCHIP (45) is the most successful British chip. It adds many of the features of the 8032 to a 40 column machine, and has numerous other functions including auto-repeat.

FASTER BASIC (E30) speeds up most Basic programs, cutting running time by as much as half. No knowledge of Basic is necessary.

PIC-CHIP (E45) makes it really simple to plot points or draw lines, but it has many other graphic facilities. Now available for the 8032.

MIKRO ASSEMBLER (E50) really does make machine language programming as simple as Basic!

SUPER-PIC (E90) is an unbeatable combination! All the facilities of Superchip and Pic-Chip in one 4k EPROM.

We have many other utilities on cassette or disk, including SPEEDSORT (E12), DISK SEARCH (E25), MASTER DIRECTORY (E22), DISK MERGE (E15) and J-K-L which copies the screen to a printer is just £8 (please state model of printer).

Prepaid orders are post free. Add 15% VAT.

SUPERSOFT

Dept P6, 10-14 Canning Road,
Wealdstone, Harrow, Middlesex
Telephone: 01-861 1166.



PROGRAMS

- 19999 REM TOO HIGH LINE NO. ROUTINE
- 20000 POKE517,0:REM SAVE OFF
- 20010 PRINT"ERROR!-LINE NOS. TOO HIGH,PICK A LOWER LINE NO NEXT TIME"
- 20020 FORT=1TO2000:NEXT:RUN

Sample run

```
50006 DATA 152, 72, 172, 249, 2, 173, 248, 2, 145, 249, 136
50016 DATA 206, 249, 2, 32, 244, 31, 104, 168, 169, 0, 96
50026 DATA 76, 185, 30, 152, 72, 32, 214, 31, 172, 249, 2
50036 DATA 169, 35, 145, 249, 238, 249, 2, 208, 2, 230, 250
50046 DATA 200, 32, 244, 31, 104, 168, 169, 0, 96, 202, 16
50056 DATA 4, 232, 76, 153, 163, 138, 72, 152, 72, 172, 249
50066 DATA 2, 174, 0, 2, 173, 250, 2, 240, 5, 173, 248
50076 DATA 2, 145, 249, 169, 32, 169, 0, 211, 202, 136, 206
50086 DATA 249, 2, 206, 0, 2, 169, 95, 157, 0, 211, 206
50096 DATA 246, 2, 173, 250, 2, 240, 3, 32, 244, 31, 104
50106 DATA 168, 104, 170, 169, 0, 96, 32, 186, 255, 201
50116 DATA 21, 240, 26, 201, 95, 240, 182, 201, 4, 240, 150
50126 DATA 201, 2, 240, 143, 201, 6, 240, 111, 201, 13, 240
50136 DATA 80, 32, 214, 31, 76, 153, 163, 56, 152, 72, 173
50146 DATA 250, 2, 240, 8, 172, 249, 2, 173, 248, 2, 145
50156 DATA 249, 238, 250, 2, 173, 250, 2, 201, 28, 240, 31
50166 DATA 201, 1, 208, 6, 173, 0, 2, 141, 249, 2, 173
50176 DATA 249, 2, 233, 32, 176, 2, 198, 250, 141, 249, 2
50186 DATA 168, 32, 244, 31, 104, 168, 169, 0, 96, 169, 0
50196 DATA 141, 250, 2, 169, 211, 133, 250, 173, 0, 2, 141
50206 DATA 249, 2, 208, 230, 169, 0, 141, 250, 2, 133, 249
50216 DATA 169, 211, 133, 250, 169, 32, 141, 248, 2, 169
50226 DATA 101, 141, 246, 2, 141, 249, 2, 169, 13, 96, 152
50236 DATA 72, 32, 214, 31, 173, 248, 2, 172, 249, 2, 145
50246 DATA 249, 141, 247, 2, 200, 238, 249, 2, 208, 2, 230
50256 DATA 250, 32, 244, 31, 104, 168, 173, 247, 2, 76, 153
50266 DATA 163, 72, 173, 0, 2, 205, 246, 2, 16, 13, 56
50276 DATA 173, 249, 2, 233, 32, 176, 2, 198, 250, 141, 249
50286 DATA 2, 173, 0, 2, 141, 246, 2, 104, 96, 177, 249
50296 DATA 141, 248, 2, 169, 95, 145, 249, 96
50316 FORX= 7865 TO 8189
50326 READA:POKEX,A
50336 NEXT
50346 POKE 536, 45:POKE 537, 31
```

PET Examination questions

by Stephen Lucking

Just for once, here's a *useful* program — well, teachers should find it useful, anyway. It allows you to build up groups of multiple choice questions, random selections of which can then be printed out for examinations.

```
10 W=100:INPUT"WILL YOU BE DEALING WITH MORE THAN 100 QUESTIONS(Y/N)";A$
20 IF LEFT$(A$,1)="" THEN 40
30 INPUT"ABOUT HOW MANY WILL YOU BE USING(Y/N)";A$
40 DIM A$(W),B$(3,W),C$(W),A1$(W),B1$(3,W),C1$(W)
45 REM
50 REM***** MENU *****
55 REM
60 PRINT"DO YOU WANT TO :-"
70 PRINT"01) MAKE A DATA TAPE"
80 PRINT"02) LOAD A DATA TAPE"
90 PRINT"03) ADD TO THE DATA TAPE IN MEMORY"
100 PRINT"04) A PRINT OUT OF ALL THE QUESTIONS"
110 PRINT"05) A LIST OF ALL THE QUESTIONS"
120 PRINT"06) TO CHECK THE QUESTIONS"
125 PRINT"07) SOME QUESTIONS PICKED RANDOMLY"
126 PRINT"08) TO PICK YOUR OWN QUESTIONS"
127 PRINT"09) TO RUN THE EXAM"
128 PRINT"10) END"
129 POKE158,0
130 INPUT"ENTER THE RANGE OF QUESTIONS TO BE USED (e.g. 0-100, 0-1000, 0-10000, 0-100000)";G:GOTO200
140 GOTO50
150 PRINT"END"
160 REM
200 REM ***** MAKE A DATA TAPE *****
201 REM
205 P=1
```

SCOOP ONLY
£29.95
+VAT
BRITISH MADE

- 52 KEY 7 BIT ASCII CODED
- POSITIVE STROBE
- +5V - 12V
- FULL ASCII CHARACTERS
- PARALLEL OUTPUT WITH STROBE
- POWER LIGHT ON CONTROL

- CHIP BY GENERAL INSTRUMENT (G.I.) TTL OUTPUT
- SUPERBLY MADE SIZE 13 x 5.5 x 1.5 ins.
- BLACK KEYS WITH WHITE LEDGERS
- ESCAPE, SHIFT, RETURN & RESET KEYS
- CONTROL, REPEAT & BELL
- Complete with DATA

HENRY'S

Professional ASCII Keyboards



The 'CHERRY' Computer Keyboard

Ideal for use with TANGERINE, TRITON, TUSCAN, APPLE and most computers. Ex-Stock from HENRY'S

This is definitely the BEST BUY. FULLY GUARANTEED. Supplied BRAND NEW in manufacturers original packing. Just post remittance total £35.95 (incl. V.A.T. & Post)

Computer Kit Division,
404 Edgware Road,
London, W2, England

01-402 6822

PROGRAMS

```

210 INPUT "HOW MANY QUESTIONS DO YOU WANT TO RECORD: ";A
220 FORX=1 TO A: PRINT "QUESTION X: INPUT ";B$;A$(X)
230 FORY=1 TO 3: PRINT "ANSWER: CHR$(Y+64)";B$;A$(X); INPUT C$(Y,X); NEXT
240 INPUT "CORRECT ANSWER = (A,B OR C) ";D$;A$(X);C$(X);NEXT
250 INPUT "DO YOU WANT TO CHECK THE QUESTIONS?";A$:IF LEFT$(A$,1)="N" THEN 390
260 FORX=1 TO A: A$(X)=0: NEXT
270 FORX=1 TO A: PRINT "QUESTION X": B$=A$(X)
280 FORY=1 TO 3: PRINT "ANSWER: CHR$(Y+64)";B$;A$(X); INPUT C$(Y,X); NEXT
290 POKE 158,0
299 PRINT "NO. K. ? "
300 GETA$:IFA$="Y" THEN 320
310 IFA$="N" THEN 300
315 A$(X)=1
320 NEXT
330 FORX=1 TO A: IFA$(X)=0 THEN 370
340 PRINT "QUESTION X": B$=A$(X); INPUT "CHANGE TO: ";A$(X)
350 FORY=1 TO 3: PRINT "ANSWER: CHR$(Y+64)";B$;A$(X); INPUT "CHANGE TO: ";D$(Y,X);B$(Y,X)
351 NEXT
360 INPUT "ANSWER = ";C$(X)
370 NEXT
380 INPUT "DO YOU WANT TO RE-CHECK THEM: ";A$:IF LEFT$(A$,1)="Y" THEN 260
390 GOSUB 3000:GOSUB 1000:GOTO 500
395 REM
400 REM ***** LOAD A DATA TAPE *****
405 REM
410 M=1:GOSUB 3000:INPUT "WHAT IS THE NAME OF THE TAPE TO BE LOADED?";T$
420 OPEN 1,1,0,T$
421 PRINT "FOUND: T$:PRINT "NOW LOADING QUESTIONS"
425 INPUT #1,A
430 FORX=1 TO A: INPUT #1,A$(X);NEXT
440 FORX=1 TO A: FORY=1 TO 3: INPUT #1,B$(Y,X);NEXT:NEXT
450 FORX=1 TO A: INPUT #1,C$(X);NEXT:CLOSE 1:GOTO 500
460 REM
465 REM ***** ADD TO DATA TAPE *****
470 REM
480 IFA$(1)=" " THEN GOSUB 2000:GOTO 500
490 PRINT "THE LAST QUESTION WAS NO. ";A
500 INPUT "HOW MANY QUESTIONS DO YOU WANT TO ADD?";Q
510 P=A+1:A=A+Q
520 GOTO 220
530 REM
535 REM ***** PRINT OUT *****
540 REM
550 IFA$(1)=" " THEN GOSUB 2000:GOTO 500
560 OPEN 4,4:FORX=1 TO A: PRINT #4," QUESTION X:PRINT #4,"
570 PRINT #4:PRINT #4,A$(X):FORY=1 TO 3:PRINT #4,CHR$(Y+64);B$(Y,X);NEXT:PRINT #4
580 NEXT:CLOSE 4:GOTO 500
590 REM
600 REM ***** LIST *****
610 REM
620 IFA$(1)=" " THEN GOSUB 2000:GOTO 500
630 FORX=1 TO A: PRINT "QUESTION X": B$=A$(X)
640 FORY=1 TO 3: PRINT "ANSWER: CHR$(Y+64)";B$;A$(X);NEXT
650 PRINT "ANSWER = ";C$(X):PRINT "PRESS ANY KEY":POKE 158,0
660 WAIT 158,1:NEXT:GOTO 500
670 REM
680 REM ***** SAVE QUESTIONS *****
690 REM
700 REM *****
710 REM
720 INPUT "WHAT DO YOU WANT TO CALL THE TAPE?";T$
730 OPEN 1,1,1,T$:PRINT #1,A
740 FORX=1 TO A: PRINT #1,A$(X);NEXT
750 FORX=1 TO A: FORY=1 TO 3: PRINT #1,B$(Y,X);NEXT
760 NEXT:FORX=1 TO A: PRINT #1,C$(X);NEXT:CLOSE 1
770 RETURN
780 PRINT "I HAVE NO QUESTIONS IN MEMORY."
790 PRINT "YOU MUST LOAD A DATA TAPE FIRST."
800 FORS=1 TO 5000: NEXT: RETURN
810 PRINT "1) LOAD YOUR TAPE INTO THE CASSETTE"
820 PRINT "2) REWIND THE TAPE"
830 PRINT "3) PRESS STOP WHEN FULLY REWOUND":POKE 158,0
840 PRINT "PRESS [SPACE] WHEN READY"
850 GETA$:IFA$=" " THEN 800
860 RETURN
870 REM *** RANDOMLY PICKED QUESTIONS ***
880 INPUT "HOW MANY QUESTIONS DO YOU WANT PICKED?";Q
890 IF Q=0 THEN PRINT "THERE ARE ONLY 'A' QUESTIONS":GOSUB 1000:GOTO 400
900 GOSUB 4030:GOTO 4050
910 FORX=1 TO A: B1$(X)=A$(X):A$(X)="":C1$(X)=C$(X):C$(X)=" "
920 FORY=1 TO 3: B1$(Y,X)=B$(Y,X):B$(Y,X)="":NEXT:NEXT
930 RETURN
940 FORX=1 TO A: A$(X)=0: NEXT
950 V=1
960 FORX=1 TO Q
970 W=INT(RND(1)*1)+1:IFA$(W)=1 THEN 4070
980 A$(V)=A1$(W):C$(V)=C1$(W):FORY=1 TO 3: B$(Y,V)=B1$(Y,W):NEXT: A(W)=1
990 V=V+1:NEXT
1000 A=0:GOTO 500
1010 REM
1020 REM *** PICK OWN QUESTIONS ***

```

SUPERBOARD UK 101

REAL-TIME CLOCK: occupies no user memory space after initial load. Time is displayed on screen to nearest minute, second or 1/100 second (user selectable). 1 min per day accuracy. Computer functions as normal, including LOAD and SAVE. Time can be stopped, started, set and read by basic programs allowing timing applications (eg Reaction timer, game timing, etc).

Program supplied on tape, with timing module which requires one connection to expansion socket, and two to computer for power. Full instructions provided, with sample program.

Send cheque or PO for £10.00 only to B H Fletcher, 3 Arne Grove, Horley, Surrey RH6 8DQ.

HOME TUTORIAL

APPLE/ITT
PET

DEBUG PROGRAMS
01-249-9895
M/C BASIC

MICROMART

OHIO IN THE NORTH

COMPUTERS AND PERIPHERALS FOR:

- * THE HOME * SCHOOLS
- * LABORATORIES
- * SHOPS * OFFICES

SPECIAL MULTI-USER SYSTEMS FOR COLLEGES.

ALL FROM:
C. T. S.

31/33 Church Street, Littleborough, Lancs.

Tel: (0706) 79332/74342

Softcentre

OVER 1500 PROGRAMS FOR CBM/PET*

NOW INCLUDING ENHANCED MICRO-POOLS PACKAGE (Sole UK Distributors)

PLUS
HEAPS OF GEAR AT REASONABLE PRICES FROM CASSETTES TO COMPLETE SYSTEMS
WHATEVER YOU WANT/WHOEVER MAKES IT IT'S PROBABLY IN OUR MASSIVE RANGE & OUR CATALOGUE IS UPDATED ALMOST DAILY.
SEND 20p STAMP FOR YOUR FREE COPY!

MOST MICROS BOUGHT, SOLD, REPAIRED
Top Royalties paid on really ORIGINAL programs — send cassette

26 ALBANY ROAD
RAYLEIGH ESSEX
Callers strictly by appointment
(0268-774089) 1pm - 8pm Mon - Sat
Dealer enquiries welcome.

DATA



CRAB SOFTWARE

presents
(for TRS-80 Level II):

DISAS (m/c) - Disassembler produces source code in EDTASM format £6-00

INVADERS FROM SPACE (m/c) - The old favourite £4-00

DEBUG (m/c) - single step through m/c programs in RAM and ROM with full control of registers + many other features £6-00

EOS (m/c) - Extended Operating System adds 17 commands to BASIC including multiple USR calls, controlled delays, shift key entries, + 8 enhanced cassette control features £8-00

TRACE (m/c) - More civilized than TRON, line number is displayed in top right hand corner. Can be used in or out of programs £3-00

MAGRATHEANS (m/c) - Battle it out with the Magratheans who are steadily whittling away the shelters protecting your bases £5-00

All prices are completely inclusive
10% discount on orders over £15
Cheques and postal orders made payable to: CRAB SOFTWARE

Order by post only to: CRAB SOFTWARE,
2 PONDWICK RD.,
HARPENDEN,
HERTS AL5 2HG

To advertise in MICROMART
Ring Jackie Hancock - 01-631 1682

MICROMART

Micros&Memories

8 x 4116, 250ns	£10.00	8035L	£ 5.80
8 x 4116, 200ns	£12.00	8243	£ 2.80
2708	£ 3.00	8085A	£ 6.80
2716	£ 3.35	8085A-2	£ 8.50
2532/2732	£ 8.80	8155	£ 9.95
2114L, ceramic, 200ns	£ 2.99	8155-2	£11.81
6514, 200ns	£ 5.30	8251A	£ 5.60
6116L, 200ns	£28.15	8253-5	£ 8.95
8264-15, 150ns	£25.00	8255A-5	£ 4.99
uPD 765	£28.15	8257-5	£10.40
Crystals - 5.6 10 MHz	£ 3.00	8259-5	£ 7.20
TTL delay lines -		8279-5	£ 9.99
100ns, 10ns taps	£ 5.99	Z80	£ 6.25
200ns, 20ns taps	£ 5.99	Z80 PIO	£ 5.75
		Z80 CTC	£ 5.75
		Z80 DMA	£19.95
		Z80 SIO/2	£29.95

Quantity discounts available on 10+ of one device

All components guaranteed new, full specification devices. Please add P & P 30p, to orders under £15. Add VAT to total.

BDS Microsystem Designs Ltd., 28, Pine-wood Close, St. Albans, Herts. AL4 0DS. Telephone: St. Albans (0727) 31831

EPROM/ RAM EMULATOR BOARD

Plugs into 78-way Nasbus and addressable on any 4k boundary by Dil switches. Up to 4k of on board ram can be loaded up by the Nascom and then used by any other system (or the Nascom itself) via a 24-way cable.

Emulates 2732, 2716, 4118, 4801, 4802 devices. Useful development tool.

Prove software before programming

eproms. Can be used as P.G.G.

Built and tested on quality board with 1K £55, Extra ram £6 per 1k. Available for other systems including PET.

Z80 CONTROLLER BOARD (ZCB 80)

Enrocard containing CPU, EPROM,

RAM, PIO and Atto D, and 2 I/O ports.

Designed for control applications. £95

Z80 SIMULATOR

Plugs into 40 pin cpu socket addresses/ ports can be read/written using its thumb-wheel/dil. Switches and 7-seg displays.

For test and development. £ P.O.A.



AID TO INDUSTRY SYSTEMS

(prices exclude VAT)

4 Dursley Close, Yate,
Bristol, BS17 4EL
Tel. (0454) 319746

HITCH-HIKERS GUIDE £16

At last — an adventure game for the PET which doesn't need disks! Based on Douglas Adams' characters (with permission from the author and Pan Books) THE HITCHHIKERS GUIDE TO THE GALAXY is a wholly remarkable game. In fact the chances of discovering such a remarkable game have been calculated as two to the power of two hundred and sixty-seven thousand seven hundred and nine to one against. By a totally staggering coincidence that is also the VAT number of SUPERSOFT who sell the program for a mere £16 plus Vagon Added Tax at 15%. Hitch-hikers will need a 40 or 80 column machine with 32k of memory. Also for cassette bound PET owners we have HALLS OF DEATH at £14 (needs 16/32k), whilst disk owners have the opportunity of sampling CATACOMBS (E27), a truly epic adventure game. Now available for 8050 drives!

VISICALC OFFER!

Buy VISICALC from us before the end of July at our regular price of £125 and we'll give you free copies of CATACOMBS and HITCHHIKERS GUIDE worth £43. Offer open to PCW readers only Prepaid orders are post free. Add 15% V.A.T.

SUPERSOFT

Dept P6, 10-14 Canning Road,
Wealdstone, Harrow, Middlesex.
Telephone: 01-861 1166



PROGRAMS

```

5001 REM
5005 FORX=1TOA: A(X)=0:NEXT
5010 FORX=1TOA: PRINT"QUESTION"X" "&A(X)
5020 FORY=1TO3: PRINT"CHR$(Y+64)"&B(Y,X):NEXT
5030 PRINT"DO YOU WANT THIS ONE "POKE158,0
5040 GETA: IFA#="Y"THENA(X)=1:GOTO5050
5045 IFA#<"N"THEN5040
5046 A(X)=0
5050 NEXT:PRINT"Q"
5055 V=1
5060 GOSUB4030:FORX=1TOA: IFA(X)=0THEN5100
5070 A(X)=A1#(X):C(X)=C1#(X):FORY=1TO3:B(Y,X)=B1#(Y,X):NEXT
5080 V=V+1
5100 NEXT: A=V-1:GOTO50
5199 REM
6000 REM ***** RUN EXAM *****
6001 REM
6010 SC=0:FORX=1TOA:PRINT"QUESTION"X" "&A(X):FORY=1TO3:PRINTCHR$(Y+64)"&B(Y,X)
6011 PRINTB(Y,X):NEXT
6020 PRINT"NO, B, OR C "POKE158,0
6030 GETA: IFA#<"A"OR"B"OR"C"THEN6030
6040 PRINTA: IFA#<"C"THEN6140
6050 PRINT"WRONG!"
6060 PRINT"THE ANSWER IS "&ASC(C(X))-64,X" "&C(X)
6070 GOTO6150
6140 SC=SC+1:PRINT"CORRECT "PRINT"YOU NOW HAVE"SC"QUESTIONS RIGHT"
6150 FORP=1TO3000:NEXT:NEXT
6160 PRINT"THAT IS THE END OF THE TEST"
6165 PRINT"YOU GOT"SC"OUT OF"ARIGHT"
6170 PRINT"PRESS [SPACE] TO RETURN TO CHOICES"POKE158,0
6180 GETA: IFA#<" "THEN6180
6190 GOTO50
10000 FORP=1TO2000:NEXT:RETURN
    
```

MZ-80K Designer

by Norman Webster

```

1 PRINT"Q":GOSUB20100:GOSUB9000:GOSUB11000
2 S=0
3 PRINT"Q"
4 GOSUB10000
100 X=53409:P=202
110 GETA: IFA#=" "THEN110
120 IF A#=" " THEN500
125 IF A#=" " THEN510
130 IF A#=" " THEN520
140 IF A#=" " THEN530
141 IF A#=" " THEN540
142 IF A#=" " THEN550
143 IF A#=" " THEN570
144 IF A#=" " THEN600
150 IF A#=" " THEN310
155 IF A#=" " THEN2
156 IF A#=" " THENPOKE X,0:GOTO309
157 IFA#=" "THEN 1
158 S=T(ASC(A#))
309 GOTO110
310 K=53248
315 WOPEN
320 B#=""
325 FORI=0TO22
330 FORJ=0TO39
332 Z#=CHR$(PEEK(K+(I*40)+J))
333 IF Z#="" THEN Z#=" "
339 B#&=Z#
340 NEXT J
345 PRINT/T B#&B#=""
350 NEXT I
360 CLOSE
500 IFPEEK(X-1)=163THEN110
505 POKEX-1,196:POKEX,S:X=X-1
507 GOTO110
510 IFPEEK(X+1)=163THEN110
515 POKEX+1,195:POKEX,S:X=X+1
517 GOTO110
520 IFPEEK(X+40)=163THEN110
525 POKEX+40,193:POKEX,S:X=X+40
527 GOTO110
530 IF PEEK(X-40)=163THEN110
535 POKEX-40,194:POKEX,S:X=X-40
536 GOTO110
540 IFPEEK(X+39)=163THEN110
545 POKEX+39,193:POKEX,S:X=X+39
    
```



FOR NASCOM 2

- 3 independent sound channels controlled by the AY-3-8910 chip
- 3" on-board speaker
- Demonstration software on cassette enables quick, simple programming of music in basic
- 60 page data manual
- All inclusive price: £39.50

For further details send sae to:

PHS ELECTRONICS

27 FENWICK DRIVE
RUGBY, WARCS.
CV21 4PQ.

ZX81 Software

A wide variety of software for the ZX81, Many games — including your old favourites. Prices from

Send SAE for details. **£3**

APOLLO 26 Vincent Rd
Thatcham Berks

MICROMART

PET'S

PETS — We Sell Them

As authorised Commodore Dealers we stock and supply all PET Hardware, Computink Discs, Oki Microine 80 Decwriter LA34, Texas 810, Qume Sprint 5 — all at competitive prices

PETS — We Buy Them

Part Exchange is very welcome, we also buy for cash.

PETS — We Hire Them

Our specialist hire service, with maintenance included for all Commodore equipment.

- Complete systems for evaluation
- Multiple units for educational courses
- Single units for individual use

From 1 day upwards, all units available. Delivery by arrangement, anywhere in UK.

PETS — Software

We are fully authorised BUSINESS SOFTWARE DEALERS for Commodore Software — COMPAY COMSTOCK, WORDPRO etc. Also PETSOFT, BRISTOL SOFTWARE, LANDSLER PAYROLL & HOTEL SYSTEM.

PLUS for ACCOUNTANTS, the unique CSM INCOMPLETE RECORDS PACKAGE — this is the best available.

MAIL — ORDER

All Hardware and Software can be bought by Mail Order Delivery by Securicor, or Registered Post. Discounts for Cash & Carry or Mail-Order. Access accepted or by Leasing (subject to acceptance)

MICRO-FACILITIES LTD

129 High Street, Hampton Hill, Middlesex, TW12 1NJ C1-979 4546 or 01-941 1197



MICROTYPE



READY CUT CASE FOR SUPERBOARD, UK101, NASCOM 2 (ALSO AVAILABLE WITH BLANK KEYBOARD FOR HOMEBREW, NASCOM 1, ETC.)

PRODUCED IN BLACK ABS PLASTIC. COMPLETE WITH SCREWS AND INSTRUCTIONS. SPACE FOR EXPANSION, FORCE FEED FAN, NUMERIC PAD AND ADDITIONAL KEYS. ONLY £24.50 + £1.50 P&P + VAT. SEND CHEQUES OR P.O.'S FOR £29.90 TO: MICROTYPE, P.O. BOX 104, HEMEL HEMPSTEAD, HERTS. HP2 7DZ. SAE FOR DETAILS. DEALER & OEM ENQUIRIES WELCOME.

PET MACHINE CODE IS EASY

when you use an assembler — like our MIKRO ASSEMBLER, the only assembler for the PET in a single chip!

Let's run through the way that you'd use MIKRO. First you switch it on with a single SYS command; MIKRO automatically turns on the Toolkit if you've got one. Then just type in lines of assembly language as if you were typing in Basic lines. As far as PET is concerned that's just what you're doing, so if you make a mistake you can move the cursor over it and type the correction.

With the Toolkit fitted you can use commands like RENUMBER, FIND, DELETE and AUTO to help you edit your program. Then when you're satisfied, just type !A to assemble your code. Don't worry, if you've made a silly mistake you will get an appropriate message!

When you want to save your source code it really is easy — because you can treat it just like a Basic program. You can even verify it, just to make sure. It doesn't matter whether you've got disks or cassette — you can even go from one to the other if you wish.

MIKRO comes with a helpful manual which gives simple examples and explanations: nevertheless we do recommend that you purchase a reference book on 6502 programming.

MIKRO COSTS £50 + VAT SUPERSOFT

Dept P6, 10-14 Canning Road, Wealdstone, Harrow Middlesex Telephone: 01-861 1166

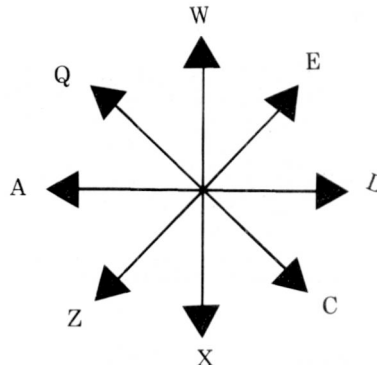


PROGRAMS

ZX81 Sketch pad

by Neil Hutton

Our first ZX81 graphics program. The controls work like this:



```

10 SLOW
20 LET A$ = INKEY$
30 IF A$ = "C" OR A$ = "D" OR A$ =
  "E" THEN LET X = X+1
40 IF A$ = "Z" OR A$ = "A" OR A$ =
  "Q" THEN LET X = X-1
50 IF A$ = "Z" OR A$ = "X" OR A$ =
  "C" THEN LET Y = Y-1
60 IF A$ = "Q" OR A$ = "W" OR A$ =
  "E" THEN LET Y = Y+1
70 IF X < 0 OR X > 63 OR Y < 0 OR
  Y > 43 THEN GOTO 30
80 PLOT X, Y
90 GOTO 20
100 END
  
```

Program packing

The article by Morgan et al in March PCW in which the authors suggested that data could be stored most economically in the form of high base numbers seems to have overlooked the fact that, no matter how presented, the computer stores data as binary fields, and that characterisation uses extra space; indeed, the high base system is merely a circuitous attempt to return the data to the binary original.

To take the example given

(the input from a 12 bit A/D converter) the data generated are already in a form that fits into a two byte field — no need to play games with numbers; store the data raw; they are already as condensed as any of the routines presented in the article could manage.

If space is really restricted, a saving of 25 percent can be effected when storing 12-bit fields on an 8-bit micro, by condensing two 12-bit num-

NASCOM BASIC

A breakdown of how it works

- * How and where GOSUB, FOR/NEXT, variable and string information is stored.
- * Description of floating point maths.
- * Data areas in the ROM listed.
- * Workspace, each byte is explained.
- * The ROM is broken down into over 200 parts with notes on each part. PRICE £5

BASIC TOOLKIT

- * Uses spare RAM 0080-1000.
- * Nine functions featuring string array SAVE/LOAD and intelligent re-number. On tape for NAS 1 or 2, with demo, program and instructions. State monitor and tape format. PRICE £6.

A.S. WATKINS 7, WARWICK CLOSE, MAIDENHEAD BERKSHIRE. Tel. (0628) 30494.

SHARP MZ80K

FULLY INCLUSIVE PRICES

MZ-80k (48k RAM) ££49
FULL SYSTEM (WITH DISCS AND PRINTER) £1725
FREE GAMES AND UTILITIES
BUSINESS SOFTWARE AVAILABLE

MZ-80k GAMES

(WITH SOUND AND GRAPHICS)

e.g. PRO-SHOT GOLF, SNAKE PIT, MANTRAP £4 each

PHONE OR S.A.E. FOR DETAILS.

MICROSPEC

143 BALMALLOCH ROAD, KILSYTH G65 9PH. TEL. 0236 821473

PROGRAMS

bers in three 8-bit bytes (12x2=8x3). Thus:

1. Store the wholly used byte of the first number.
 2. Store the wholly used byte of the second number.
 3. Assemble the two remaining 4-bit sections into one byte.
 4. Store the assembled byte.
- The process is reversed when

the stored data are later retrieved.

I am not familiar with Basic, so I cannot suggest any byte assembly/disassembly routines in that language, but the code in Figure 1 should run on a PET, or any other 6502 machine.

Derek Moody, Dorchester, Dorset

Code	Mnemonic	
AD	LDA	; To assemble two 4-bit remainders held in
YZ	YZ	; address WXYZ (any location)
WX	WX	; and address STUV into one byte,
29	AND	; and put the result into WXYZ.
0F	OF	
0A	ASL	; ie, if WXYZ contains 05
0A	ASL	; and STUV contains 0A
0A	ASL	; after running
0A	ASL	; WXYZ contains 5A
8D	STA	
YZ	YZ	
WX	WX	; This subroutine is relocatable, and
AD	LDA	; WXYZ and STUV may be anywhere in memory.
UV	UV	
ST	ST	
29	AND	
0F	OF	
18	CLC	
6D	ADC	
YZ	YZ	
WX	WX	
8D	STA	
YZ	YZ	
WX	WX	
60	RTS	; Return to calling routine.

Code	Mnemonic	
AD	LDA	; To disassemble the byte held in WXYZ and put the
YZ	YZ	; results into addresses WXYZ and STUV.
WX	WX	
AA	TAX	; ie, if WXYZ contains B6.
29	AND	; After running,
F0	F0	; WXYZ contains 0B
4A	LSR	; and STUV contains 06
4A	LSR	
4A	LSR	
4A	LSR	
8D	STA	
YZ	YZ	
WX	WX	
8A	TXA	
29	AND	
0F	OF	
8D	STA	
UV	UV	
ST	ST	
60	RTS	; Return.

MICROCHESS

Continued from page 68

will be held as part of the Fourth Personal Computer World Show at the Cunard Hotel, Hammersmith, London, 10-12 September.

The closing date for entries is 15 August 1981, although entries may be accepted after that date at the discretion of the organising committee.

SIXTY ZX81 or ZX80 PROGRAMS

60 1K program listings for only £4.95. Specify which. Includes many games, Home Finance, Utility, Maths, Chequebook and more. Also includes Hints'n'Tips.

BUSINESS OPPORTUNITY

Are you missing out on the greatest business opportunity this century? New computer career opportunities, full or part time, any area, little or no capital needed. Training avail. SAE details. Self teach prog course avail. SAE details.

SUSSEX SOFTWARE (DEPT PCW2), WALLSEND HOUSE, PEVENSEY BAY, SUSSEX.

DYNADRIE PERIPHERALS

Harbour Road
Troon KA10 6DU

We sell:

COMPUTER POWER SUPPLY UNITS — £69

+ 5v at 5 Amps — + 5v has logic shutdown capability and over voltage protection

-5v at 1 Amp

+12v at 1 Amp

-12v at 1 Amp

STANDARD 8 INCH FLOPPY DISCS — £2.75

£24.50 for 10

PHONE US AND LET US KNOW OF YOUR

PERIPHERAL REQUIREMENTS

Postage free on orders over £20.

Cheque with order, add V.A.T. at current rate.

SAME DAY DESPATCH

FURTHER PRODUCTS PENDING

Tel.: 0292-311800

Telex: 778978

MICROMART

LONDON COMPUTER CENTRE

Unique! Superbrain and WordStar Users! Upgrade your WordStar with the WordStar Patch plus

20 multi-coloured key tops.

By adding 20 multi-coloured dedicated function keys, you will upgrade your WordStar.

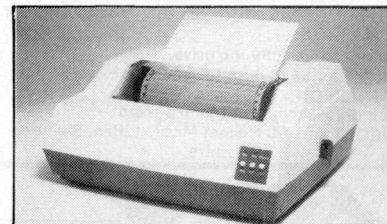
In CPM all keys as normal. Under WordStar numeric pad becomes dedicated functions. For your WordStar Patch plus 20 Multi-coloured Key Tops send £65

with order to:

**LONDON COMPUTER CENTRE
(MAIL ORDER DEPT TC1)
43 GRAFTON WAY, LONDON
W1P 5LA.**

SUPERCASE — will support your T.V. For UK 101/SUPERBOARD & others. Rigid 4 part metal case, back punched for DIN sockets, mains fuse & switch. Removable rear panel for easy mounting of own sockets etc. State computer type. PCB supported by rigid inclined plate.
£28.00 + £3 p.& p.

SUPER PRINTER — COMET 8300P by C. ITOH SAVE £160



Fast 125 cps Bi directional 80/132 Column continuously rated business printer. Uses ex-stock paper. **£280 p.p.** at cost.

SUPER INTERFACE — Gives SUPERBOARD/UK101: 2-8 Bit output ports, 1-8 Bit input port 1-4 Bit input port, Tape motor relay. This will drive Centronics parallel interface with **NO** extra software, just plug in then one POKE and all PRINT statements can operate the printer.
£25.00 + 50p p.&p. built & tested.

SUPER VIDEO — 12" Hi. Resolution Monitor. 12 MHz. — Low distortion (2½% max.) Open frame. Centre Res. — 900 lines. Corner Res. — 750 lines. Green screen/Antireflective coating **£85.00** White screen P4 Phosphor **£78.00**

PRINTER KITS — Limited offer. 40/80 Column bi-Directional printer mechanism. Driver card with Centronics interface & case. Requires 24V & 5V power supply. Similar to above printers.
£180.00 + p.p. at cost.

Add 15% VAT to all orders. Ring or write for further details.

**Jayman Electro Devices Ltd,
15 Ash Grove, Springhead Oldham,
Lancs, OL4 4RD
Tel No. 061-652 1604**

MICROMART

VASTLY INCREASE YOUR MICRO'S CAPACITY WITH

CP/M FORTRAN-80 OVERLAYS

VERA[®] is a simple root + segment overlay system. Supplied as 250 line 8080 assembler listing plus manual. £63 inc. vat from:

ENGINEERING COMPUTATIONS	3 Clissold Court, Green Lanes, London N4 2EZ	Enquiries 800 3362
-----------------------------	--	-----------------------

NASCOM SOFTWARE

We offer the following quality software for NASCOM systems:

NASPAS — a 12K PASCAL compiler which produces Z80 code directly i.e. no P-code. The compiler offers floating point and integer arithmetic, arrays, sets, strings and all major Pascal statements together with fully recursive functions and procedures with value and variable parameters. The object programs run very quickly. Price: £35.00

NASMON — A new monitor for NASCOMs. Occupies 4k and includes a sophisticated screen editor, a 'front panel' mode, blocked and buffered tape routines and powerful debugging commands. Price: £30.00 in EPROM

BAS12K — a 12K BASIC interpreter offering 11 digit precision arithmetic, PRINT USING, IF... THEN... ELSE and other advanced features. Price: £25.00

NASGEN — a fast 3K assembler generating a full symbol table and with many assembler directives and commands. Price: £15.00 on tape, £25.00 in EPROM.

NASNEM — a 2½K disassembler which interfaces to NASMON's front panel to produce single step disassembly. Optionally it produces labels and o/p may be directed to a text buffer suitable for NASGEN. Price: £10.00 on tape, £15.00 in EPROM.

All the above software runs under NASMON except NASPAS which can run under NASMON or NASSYS.

All prices are fully inclusive.

FREE: a free CHESS program with every order of NASMON.

Full details may be obtained from:

HISOFT 60 Hallam Moor, Liden, Swindon Wiltshire.

Zx80 Tolinka

Use your 16K Zx80 as a powerful chess recording machine.

This 7K programme features on screen:

- ♔ Double board so each player sees board from his point of view.
- ♔ Move indicator.
- ♔ Move number.
- ♔ Pieces on both boards moved simultaneously.
- ♔ Stores 20 games per C60 cassette.

Send cheque/P.O. for £3.99 to receive Tolinka (cassette and listing), plus lists of other high quality software to:

Second Foundation
M.P. Biddell, 22 Bramber,
Belgrave, Tamworth, Staffs B77 2LL.

158 PCW

Confirmation of acceptance or rejection of entries will be made known by 25 August 1981.

The full rules were published in the June 1980 PCW.

All queries regarding the competition shall be addressed to: Second European Microcomputer Chess Championship, *Personal Computer World*, 14 Rathbone Place, London W1P 1DE.

CALCULATOR CORNER

Continued from page 130

an analysis of the flow structure shows that the reverse sequence will execute faster, providing $p(A+B+2C) > 2A+D$.

The beauty of Figure 3(b) is that if we modify the steps INV DSZ, GOTO 0 by replacing them with INV DSZ, INV NOP, MRO, INV x = 0, then the loop GOTO 0/BL 0 will be followed once only and the reverse sequence will be faster if:

$p(A+B+2C) > A$ as $p \rightarrow 1$ this will invariably hold.

Operation	Execution time in seconds 10,000 steps	Comments
INV NOP	27.0	
+	123.2	1 + + =
X	200.3	1 x x =
Min 0	89.2	1 Min 0
MR 0	64.0	
M+0	167.2	1 * M + 0
GSB	10.7	Read time 10,000 steps
GOTO	11.8	Read time 10,000 steps

Fig 4. Comparison of execution and read times.

TOM'S TANDY PROBES PRANGS

Continued from page 95

would be possible for the program to be made available to insurance companies, probably on a time-sharing system, so that he can keep control over changes and updates without getting into immense administration hassles. In this way, insurance clerks would be able to check claim forms as they come in. The system could easily be modified to talk

in terms of 'wet tarmac' instead of 'a coefficient of friction of 0.5', making things far more user-friendly.

And Tom knows that exactly the same principles could be applied to any sort of disaster, including shipping and aeroplanes. The potential to make a fortune there must be vast, but Tom's overriding concern is to have just enough money coming in so that he can continue his vital research into road safety. He tells me that when you've dug a few people out of crashes, all the fortunes in the world seem rather irrelevant.

SECRETS OF SYSTEMS ANALYSIS

Continued from page 83

be careful to store paper records properly and take copies of anything which might get lost; well, now you have to do this with your data files. You've probably forgotten by now that you had to learn how to look after paper with things written on it. Kids

know that by the time they get to school. You'll remember learning about how to file bits of paper, even if you did find it a bit of a bore. Looking after computerised data is actually easier, even though you can't see what's happened to the data by looking at the disk.

Next month

Next month will be the final installment, covering the monitoring of a system in operation and listing a whole lot of books that you might like to read.

BLUDNERS

Beat you to it this month — page 104, fourth paragraph: there are many hundreds of possible states in noughts and crosses but not during the course of a single game. And the Acorn Atom Maze program published in April: lines

248, 256, 266 contain characters which look like colons (:) should be inverse backslashes. Finally, last month's UK101 Zor, line 180, contains POKE L — 44,96, but the minus sign didn't reproduce clearly on some copies.

SOFTWARE

WE WRITE PROGRAMS TO
FIT YOUR REQUIREMENTS
SPECIALISTS IN PET SOFTWARE



ARMbAM LTD
KILN LANE
LEIGH
TONBRIDGE
KENT TN11 8RT

HILDENBOROUGH 832130

NEW

TRS 80
MODEL III



The Model III has arrived in the U.K.

★ NEW FEATURES AVAILABLE ★

★ Upper and Lower Case characters (standard) ★ Real Time Clock ★ 500 or 1500 Baud Cassette ★ Parallel Printer Interface (standard) ★ Auto Repeat keys ★ Flashing Cursor ★ New Characters, Greek, Japanese Kana ★ Numeric Keypad ★ 16 32 or 48K ★ Room for two D.D. Disc Drives & Interface ★ 12" VDU ★ All in stylish cabinet

16K £649 INCLUSIVE

S.a.e. Enquiries. Delivery 4-6 weeks

N.I.C.

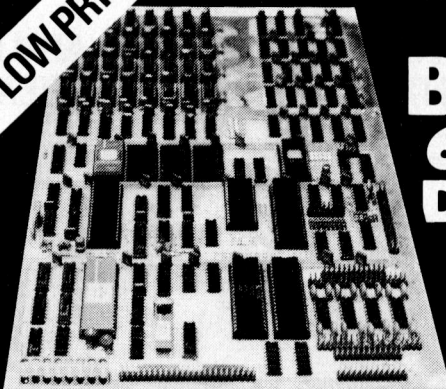
Unit 7, 61 Broad Lane, London N15 4DJ
Daytime 01-808 0377 Evenings 07-889 9736



**Micro
byte**

We bring you the lowest prices-first!
Compare our prices before you buy elsewhere! All devices are brand new, factory prime, full spec. and fully guaranteed!

NEW LOW PRICE



Introducing the incredible
BIGBOARD Single Board Computer
64K RAM! Z-80 CPU! FLOPPY DISK CONTROLLER! 24x80VDU! PFM 3.3 2K SYSTEM MONITOR! ALL THIS ON ONE BOARD COMPLETELY ASSEMBLED AND JUST
plus £5 p&p and VAT
£375!
BARE PCB AND ROMS £150+ P+P + VAT

NEW 6809 S-100 SINGLE BOARD COMPUTER
● Meets IEEE S-100 Standard!
● Uses Motorola's Powerful MC6809 CPU!
● 4K, 8K, 16K ROM!
● 2K RAM!
● ACIA, PIA, 8080 Simulated I/O!
SALE!
BAREBOARD now only £35
ADSMON, Monitor (2716) now only £15,

THE NEW GI COMPUTER SOUND CHIP
NEW LOW PRICE ONLY £5.95

The amazing AY-3-8910 is a fantastically powerful sound and music generator, perfect for use with any 8-bit micro processor. Contains 3 tone channels, noise generator 3 channels of amplitude controls 16 bit envelope period control 2 parallel I/O. 3D/A converters plus much more. All in 40 pin DIP Super easy to interface to the S 100 or other Busses. **£5.95**

ONLY £8.50 + VAT, including FREE reprint of BYTE 79 article! Also, add £2.25 for 60 page data manual. "Perhaps the next famous composer will not direct a 150 piece orchestra but rather a trio of microcomputers controlling a bank of AY-3-8910s. BYTE July '79.

SALE! EXCITING, ENTERTAINING SOFTWARE FOR THE APPLE II and APPLE II, PLUS!! **ASTEROIDS IN SPACE!!!**

If you liked Invaders you'll love ASTEROIDS IN SPACE by Bruce Wallace! Your spaceship is travelling in the middle of a shower of asteroids. Blast the asteroids with lasers, but beware - BIG ASTEROIDS FRAGMENT INTO SMALL ASTEROIDS! The apple game paddles allow you to rotate your spaceship, fire its laser gun, and give it thrust to propel it through endless space. From time to time, too, you'll encounter an alien spaceship whose mission is to DESTROY YOU, so you'd better destroy it first! High resolution graphics and sound effects add to the arcade-like excitement this program generates. RUNS ON ANY APPLE II WITH AT LEAST 32K AND ONE DISK DRIVE!
ON DISKETTE ONLY £9.95 WHILE STOCKS LAST

Sensational low price on 64K Dynamic RAMs. Only £12.95

Minimum order: 8pcs (p&p 50p & VAT) (for quantity 1-7, £14.95 + p&p + VAT) Ex STOCK WHILE SUPPLY LASTS!
From HITACHI. HM4864-3 (65K x 1) 200NS, Single + 5V Supply, 16 pin. Complete with Data sheet and Cross reference list.

NEW, LOW, LOW PRICES ON MEMORIES!!!

Compare our prices before you buy elsewhere! All devices are brand new, factory prime, full spec. and fully guaranteed!
All prices exclude p&p and VAT. Please refer to Ordering Information before ordering.
DON'T DELAY - BUY TODAY - SUCH LOW PRICES DON'T LAST FOR EVER!!

STATIC RAMS	1-24	25-99	100+	CMOS RAMS	1-24	25-99	100+
2114L 200 NS				TC5514P 4K (1Kx4)			
Lower Power	1.60	1.45	1.30	Same as 6514 450 NS	£3.25	£2.95	£2.60
4118 250 NS	6.95	6.25	5.95	HM6116 16K (2Kx8)			
				200NS	£12.95	£11.95	£9.95
DYNAMIC RAMS				EPROMS			
4116 150 NS	£2.50	£2.25	£1.95	2708 450 NS	1.24	25-99	100+
4116 Ceramic Package				2716 5V 450 NS	2.95	2.75	2.50
Gold Plated 200 NS	£1.40	£1.25	£1.15	2532 5V 450 NS	8.95	8.50	8.25
HM4864 64K (64kx1)				2732 450 NS	8.95	8.50	8.25
Single 5V 200 NS	£14.95	£13.95	£12.95				

RIBBON CABLE AND CONNECTORS

Type	Ways	Price each	Price each - assembled with 1 metre cable
IDC Socket	10	1.25	2.95
	16	1.95	3.95
	26	2.95	4.95
	40	3.50	5.95
	50	4.50	7.50
P.C.B. Mounting Block Header	10	1.25	
	16	1.75	
	26	2.50	
	40	3.25	
	50	3.95	
IDC Edge Connector (for 8" Disk Drives)	50	4.95	7.95

All Bigboard Interfacing is by block headers and require flat ribbon cable (IDC) type header sockets. We stock all necessary types.

	Price/Metre
Ribbon Cable 26	1.49
40	2.30
50	2.90

Three years' development went into BigBoard, designed from scratch to run the latest version of CP/M, so just imagine what software you could run WITH NO MODS! Add a couple of 8" Disk Drives, a Video Monitor and Keyboard, an enclosure and the Power Supply option - and you've got a complete business system for about ONE THIRD the COST!

That's what BigBoard can offer - flexibility, power, and incredible economy! Send for your BigBoard TODAY!

Size 8½ x 13¼ inches.
Requires +5V @ 3 Amps
+/- 12V @ 0.5 Amps.

PLUS THESE OPTIONS ON THE BOARD £75+ VAT

Serial I/O	Full 2 channels using the Z-80 SIO and the SMC 8116 Baud Rate Generator. You get FULL RS232C! For synchronous or asynchronous communication, and clocks can be transmitted or received by a modem in the former. Both channels can be set up for either data communication or data terminals. Supports mode 2 int.
Two Port Parallel I/O	Uses Z-80 PDI to give full 16 bits, fully buffered and bi-directional. Uses selectable hand-shake polarity. ONLY £20 (inc. p&p)
Real Time Clock	Uses Z-80 CTC and can be configured as a counter on Real Time Clock
CP/M 2.2	The popular CP/M 2.2 as modified by Micronix. Including Monitor, Listing and Printer Routine £150 + VAT
Power Supply	For Bigboard + 2 Diskdrive £175 (£30&p)

Floppy disk Drives Siemens S/D, S/S £275, YE174 D/D, D/S £375
Full set of cables and connectors for Bigboard only £25.

Microchips at micro prices!

INTERFACE LINEAR	SUPPORT DEVICES	CPU'S
MC1488 70p	6521 325p	6502 600p
MC1489 70p	6522 525p	6504 850p
DM8123 125p	6532 795p	6505 700p
75150 125p	6551 800p	6800 400p
75154 125p	6810 225p	6802 800p
75182 195p	6820 330p	6809 £14
75322 250p	6821 195p	8080A 400p
75324 325p	6845 £14.00	8085A 800p
75325 325p	6850 200p	
75361 350p	6852 325p	
75365 295p	8212 150p	EPROMs
75451 50p	8214 425p	2708 450 NS 375p
75491/2 75p	8216 160p	2716 5V 450 NS 495p
8T26 140p	8224 260p	2532 32K 450 NS 895p
8T28 140p	8228 395p	2732 Intel-type 450 NS 895p
8T95 140p	8251 450p	2564 64K (8K x 8) 450 NS 28-pin NEW! £75
8T97 175p	8253 795p	
	8255 445p	
	8257 795p	
	8259 795p	
KEYBOARD ENCODER	MC144 12VL 995p	
AY-5-2376 795p	Z80 P10 395p	FLOPPY DISK CONTROLLERS
KR 3600 695p	Z80 CTC 395p	FD1771 B-01 S/D Inverted Bus £18
	Z80A P10 495p	FD1791 B-01 D/D Inverted Bus £29
	Z80A CTC 495p	
	Z80 DMA £10.95	
	Z80A DMA £11.95	
CHARACTER GENERATOR	Z80S10/0 £22.95	
RO-3-2513 UC 450p	Z80AS10/0 £24.95	
	Z80S10/1 £22.95	
	Z80AS10/1 £24.95	
	Z80S10/2 £22.95	
	Z80AS10/2 £24.95	
DEVELOPMENT MODULE	UARTS	
Z8000 DM £1099	AY-5-1013A 325p	
	AY-3-1015D 398p	
	IM6402 IPL 325p	

Ordering information. Unless otherwise stated, for orders under £50 add 50p p&p. Add 15% VAT to total (no VAT on books). All devices are brand new, factory prime and full spec. and subject to prior sales and availability. Prices subject to change without notice. Minimum telephone order using ACCESS is £10. If ordering by post with ACCESS, include name, address and card no. written clearly. Please allow 4/6

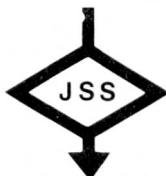
weeks delivery on books.
The Micro Division of Macklin-Zand Electronics Ltd.

**Micro
byte**

Microbyte,
Dept. PCW8 Unit 9/10,
1st Floor, E Block,
38 Mount Pleasant,
London WC1X 0AP.
Telephone: 01-278 7369
Telex: 895 3084

TAKE CONTROL

WITH YOUR APPLE][



SIMPLY PLUG A J S SYSTEMS PIP INTERFACE CARD INTO A SLOT IN YOUR APPLE AND CONVERT IT INTO A POWERFULL MEASUREMENT AND CONTROL SYSTEM

All PIP cards incorporate:

★ STEP MOTOR CONTROL

Programmable number of steps,
speed and direction

★ CRYSTAL CONTROLLED TIMER

Programmable from 0.1 secs
to 108 mins.

★ COUNTER INPUT (PIP 1)

Up to 4 channels of counting

★ VOLTAGE INPUT (PIP 2)

10 bit ADC with 30 usec convert

You can then specify:

or :

PIP 1: £337 Counter input

PIP 2: £397 Voltage input

also

PIP 0: £337 (a step motor control only card)

PIP X/Y (for X/Y drive systems control)

We can also supply step motor drives and
advise on your choice of motor

Driving programs supplied

Special purpose software for spectrometers

COST EFFECTIVE CONTROL from J S Systems Ltd

18 PORTMAN ROAD, READING. 0734 599615

THE NEW DEAL FOR AUTHORS

A scheme for marketing software by the authors on a co-operative basis

Copyright is retained by the author.

A license is given to the Company to copy for marketing only.

Authors receive 90% of profits in direct proportion to the value of their sales to
total sales.

Guaranteed return to the author of 25% of sale value at time of sale.

Balance of distributable profits determined by annual audit subject to scrutiny
of trustees appointed by the Members.

Co-opsoft Limited

To:
Co-opsoft Limited
10 Triangle South
BRISTOL
BS8 1EY

Enclose SAE for reply

I am interested in the scheme. Please send detailed prospectus.
I enclose a brief description of a programme(s) I may wish to market.
(Indicate when available, approximate selling price and hardware required.)

Name

Address



COMPUTER WAREHOUSE

NOW OPEN
MONDAY-SATURDAY
9.30-5.30

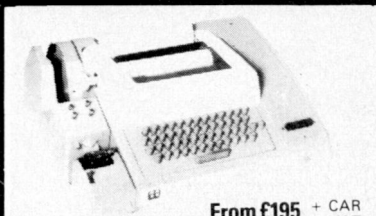
RAM AND EPROM NEW LOW VAT INCLUSIVE PRICES

2716 5v Rail	£7.50	4116	200 NS 16KX1 DYN.	8 for £19.95
2716 3 Rail	£8.50	2114L-3	300 NS 1KX4 ST.	8 for £22.50
2708 450 NS	£4.50	2102L-3	650 NS 1KX1 ST.	8 for £ 5.50
2708 Ex Equip	£2.25	TMS4030JL	300 NS 4KX1 DYN	8 for £ 9.95

All devices full spec. and guaranteed. Bulk enquiries welcome.

In stock now test equipment, microprocessors, teletypes, transformers, power supplies, scopes, sig. gen's, motors, peripheral equipment, I.C.'s, tools, components, variacs, keyboards, transistors, microswitches, V.D.U.'s sub-assemblies + thousands of other stock lines. Just a mere fraction of our vast range, is displayed below: 100's of bargains for callers.

TELETYPE ASR33 I/O TERMINALS

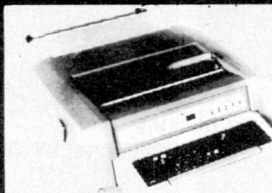


From £195 + CAR
+ VAT

Fully fledged industry standard ASR33 data terminal. Many features including: ASCII keyboard and printer for data I/O, auto data detect circuitry, RS232 serial interface, 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order.

Options: Floor stand £12.50 + VAT
Sound proof enclosure £25.00 + VAT

ICL TERMIPRINTER 300 BAUD TERMINALS

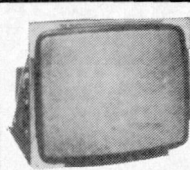


PRICES
REDUCED

ONLY
£295
+ CAR
+ VAT

Made under licence from the world famous GE Co. The ICL Termiprinter is a small attractive unit with so many features it is impossible to list them in the space available! Brief spec. as follows: RS232 serial interface, switchable baud rates 110, 150, 300, (30 cps), upper and lower case correspondence type face, standard paper, almost silent running, form feed, electronic tab settings, suited for word processor applications plus many more features. Supplied in good condition and in working order. Limited quantity.

SCOOP PURCHASE 12" VIDEO MONITORS



CONNECT
DIRECT TO
YOUR MICRO

Made by the "BALL MIRATEL" CORPORATION USA the CD12 is a self contained, mains powered chassis professional monitor. All controls are inbuilt on a single PCB with exception of the brightness control which can be brought out for external use. Many features such as composite video, quoted bandwidth of 19 Mhz, superb linearity and definition make this a must for any MICRO/CCTV application.

Brand new and boxed only
+ carriage £7.50 + VAT.
£97.50 + VAT
Input harness, brightness pot and connector £2.50
+ VAT. Dimensions 9"H x 11"D x 11 1/2"W

HURRY WHILE STOCKS LAST

EX STOCK SOFTY

EPROM BLOWER

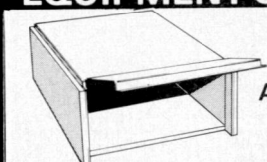
Software development system invaluable tool for designers, hobbyists, etc. Enables open heart surgery on 2716, 2708 etc. Blows, copies, reads EPROMs or emulates EPROM/ROM/RAM in situ whilst displaying contents on domestic TV receiver. Many other features. £115 + carr. + VAT. Optional 2716, 2716 Function Card £40 + VAT. PSU £20 + £1.50 carr. + VAT.
Write or phone for more details.

JUST IN

Secondhand chassis 9" Blue-best mains powered, video monitors, composite video input with inbuilt 5v 3 amp DC P.S.U. Tested, but unguaranteed.

£39.99 - £7.50 carriage
Complete with circuit.

EQUIPMENT CASES

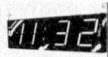


GIVE
YOUR
M.P.U.
A HOME
ONLY
£9.95
+ 1.95 pp

Superb professional fully enclosed, made for the G.P.O. to the highest standard, offered at a fraction of their original cost they feature aluminium sides, hinged removable front panel, which can be secured by 2 screws to prevent prying fingers. All are finished in two tone G.P.O. grey and although believed brand new may have minor scuff marks/scratches due to bad storage. Dimensions 16"D x 6 1/2"H x 14 1/2"W

NATIONAL MAT1012 LED CLOCK MODULE

- ★ 12 HOUR
- ★ ALARM
- ★ 50/60 HZ



The same module as used in most ALARM/CLOCK radios today, the only difference is our price! All electronics are mounted on a PCB measuring only 3" x 1 1/2" and by addition of a few switches and 5/16 volts AC you have a multi function alarm clock at a fraction of cost. Other features include snooze timer, am pm, alarm set, power fail indicator, flashing seconds cursor, modulated alarm output etc. Supplied brand new with full data only
Suitable transformer £1.75.

£5.25

SEMICONDUCTOR 'GRAB BAGS'

Amazing value mixed semiconductors, include transistors, digital, linear I.C.'s, triacs, diodes, bridge recs. etc. All devices guaranteed brand new, full spec. with manufacturers markings, fully guaranteed.
50 + BAG £2.95 100 + BAGS £5.15

MUFFIN FANS

Keep your equipment Cool and Reliable with our tested ex-equipment "Muffin Fans" almost silent running and easily mounted. Available in two voltages. 110 V.A.C. £5.05 + pp 90p OR 240v A.C. £6.15 + pp 90p DIMENSIONS 4 1/2" x 4 1/2" x 1 1/2"

ELECTRONIC
COMPONENTS
& EQUIPMENT

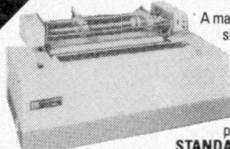
66%
DISCOUNT

Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s, Transistors, Relays, Cap's., P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads., we are packing all these items into the "BARGAIN PARCEL OF A LIFETIME" Thousands of components at giveaway prices! Guaranteed to be worth at least 3 times what you pay plus we always include something from our ads. for unbeatable value!! Sold by weight

2.5kls £ 4.75 + pp £1.25
10kls £11.75 + pp £2.25
5kls £ 6.75 + pp £1.80
20kls £19.99 + pp £4.75

THE PRINTER SCOOP OF THE YEAR THE LOGABAX Z80 MICROPROCESSOR CONTROLLED LX180L MATRIX PRINTER

SAVE
OVER £1400



A massive bulk purchase enables us to offer you this superb professional printer at a fraction of its recent cost of over £2000. Utilising the very latest in microprocessor technology it features a host of facilities with all electronics on one plug in P.C.B. Just study the specification and you will instantly realise it meets all the requirements of the most exacting professional or hobbyist user.

STANDARD FUNCTIONS ★ Full ASCII character set ★ Standard ink ribbon ★ RS232/V24 serial interface - 7 xtal controlled baud rates up to 9600 ★ 194 characters per line ★ Parallel interface ★ Handshakes on serial and parallel ports ★ 4 Type fonts, italic script, double width, italic large, standard ★ Internal buffer ★ Internal self test ★ 170 CPS ★ Variable paper tractor up to 17.5" wide ★ Solid steel construction ★ All software in 2708 eeproms easily reconfigured for custom fonts etc.

All this and more, not refurbished but BRAND NEW At Only **£525 + VAT**
+ carriage and ins. £18.00 + VAT
OPTIONAL EXTRAS ★ Lower case £25.00 ★ 16K buffer £30.00 ★ Second tractor for simultaneous dual forms £85.00 ★ Logabax maintenance. P.O.A.

MAJOR SAVINGS HARD DISK DRIVES

Another major purchase allows us to bring you the professional technology of hard disk drives at a price you can now afford. Just imagine absolutely masses of correct data transferred or saved on your system by the time your finger leaves the carriage return key!! All drives offered are made to the highest professional standard by the DRE Co., perhaps the largest of UK OEM peripheral manufacturers. All components are batch selected to obtain the utmost reliability and after having run two series 30 and a 4000 drive continuously 24 hours a day for over a year without a single read/write error we can most certainly vouch for the quality.
DIABLO/DRE series 30. Fully refurbished this 2.5 MB drive accepts 2315 exchangeable (via removing top cover) disk cartridges. Sectoring is a feature of the disk pack and may range from 8-48. Fully DEC RK05, Nova, Texas, system compatible. Requires + & -15v DC Supply.
Series 30 Drive £475 + VAT Series 30 Front Loader £695 + VAT
DC Power Supply £125 + VAT
DRE 4000 B Series. Model 4044. Technology at its finest, this drive currently manufactured by DRE features 10 MB's of on line storage split into two disk platters, 1, 5 MB fixed and 1 top load 5 MB type 5440 exchangeable cartridge. Features, DC drive motor, built in air conditioning system, write protect, mains powered, etc. Supplied **Brand New** and Boxed complete with Manual and Rack Slides.
Manufacturers current price **£3100**, our price **£1495 + VAT**

*For DEC compatibility or alternate sectoring please enquire. Xylogics DEC LSI 11 controller for 4 S30 or 2 4000 drives £850 + VAT Newton Labs S100 controller for 4 S30 or 2 4000 £625 + VAT Controller for TRS80, PET, APPLE, price to be announced. NEW 2315 12 sector disk packs £40 + VAT
NEW 5440 any sector packs £48 + VAT
ORDER NOW!! These prices may never be repeated. Specialist carriage S30 £15.00 + VAT 4000 £20 + VAT.

STEP INTO THE 80's WITH TOMORROW'S WORLD TECHNOLOGY TODAY

THE TANTEL PRESTEL-VEWDATA ADAPTOR

At last this amazing piece of micro technology is available at a price you can afford. Just connect to the aerial socket of any colour or black and white domestic TV receiver and to your Post Office installed jack socket and you are into the exciting world of PRESTEL. Via simple push button use you are able to view a staggering 170,000 pages of up to the minute information on many services and utilities, order goods from companies, even play games!! All this and more without ever leaving your armchair!

ONLY £170
+ £1.75 carr. + VAT
SEND £197.51

RCA FULLY CASED ASCII CODED KEYBOARDS



IDEAL -
TANGERINE,
OHIO ETC.

Straight from the U.S.A. made by the world famous R.C.A. Co., the VP600 Series of cased freestanding keyboards meet all requirements of the most exacting user, right down to the price! Utilising the latest in switching technology. Guaranteed in excess of 5 million operations. The keyboard has a host of other features including full ASCII 128 character set, user definable keys, upper/lower case, rollover protection, single 5V rail, keyboard impervious to liquids and dust, TTL or CMOS outputs, even an on-board tone generator for keypress feedback, and a 1 year full R.C.A. backed guarantee.

VP601 7 bit fully coded output with delayed strobe, etc. **£43.95**
VP611 Same as VP601 with numeric pad. **£54.95**
VP606 Serial, RS232, 20MA and TTL output, with 6 selectable Baud Rates. **£60.95**
VP616 Same as VP606, with numeric pad, Plug and cable for VP601, VP611 **£72.50**
Plug for VP606, VP616 **£2.10**
Post, Packing and Insurance. **£1.95**
ORDER NOW OR SEND FOR DETAILS.

5v D.C. POWER SUPPLIES

Following the recent "SELL OUT" demand for our 5v 3 amp P.S.U. we have managed to secure a large quantity of ex-computer systems P.S.U.'s with the following spec.; 240 or 110v A.C. input. Outputs of 5v @ 3.4 amps, 7.2v @ 3 amps and 6.5v @ 1 amp. The 5v and 7.2v outputs are fully regulated and adjustable with variable current limiting on the 5v supply. Unit is self contained on a P.C.B. measuring only 12" x 5" x 3". The 7.2v output is ideal for feeding "on board" regulators or a further 3 amp LM323K regulator to give an effective 5v @ 7 amp supply.
Supplied complete with circuit at only **£10.95 + £1.75pp.** Believed working but untested, unguaranteed.

ELECTRONICS

Dept. P.C.W. 64-66 Melfort Rd., Thornton Heath,
Croydon, Surrey. Tel: 01-689 7702 or 01-689 6800

MAIL ORDER INFORMATION

Unless otherwise stated all prices inclusive of V.A.T. Cash with order. Minimum order value £2.00. Prices and Postage quoted for UK only. Where post and packing not indicated please add 60p per order. Bona Fida account orders minimum £10.00. Export and trade enquiries welcome. Orders despatched same day where possible. Access and Barclaycard Visa welcome.

SOLE UK DISTIBUTER



A DYNAMIC REVOLUTIONARY CONCEPT IN APPLE WORD PROCESSING



Magic Window
word processing system

PRICE £ 79.95 + V.A.T.
postage and packing free

Novice typists to professional secretaries and administrators are amazed at the ease and simplicity of **MAGIC WINDOW**.

MAGIC WINDOW is a Apple II word processing/text editing system that is designed to increase your office productivity—those time-consuming typing tasks can now be done quickly and efficiently.

The simplest and best-known word processing machine is the standard typewriter. We have retained the simple operating features of the typewriter while providing complete editing facilities.

MAGIC WINDOW is a word processing system that allows text to be entered, edited, printed, and saved on a diskette. **MAGIC WINDOW** is unique in the way it performs these functions.

Most systems separate the tasks of editing text and formatting for printing. This separation requires formatting commands to be placed in the text file. **MAGIC WINDOW** has no need for these commands because it formats the text as you enter it. What you see is truly what you get. There is no guesswork in laying out your document.

MAGIC WINDOW will instantly convert your Apple system into a word processor—no modifications or fancy gadgets to buy. Simply insert the **MAGIC WINDOW** diskette into your disk drive and experience word processing as never before.

MAGIC WINDOW allows you to type up to EIGHTY CHARACTERS per line! This allows you to see your letter report, etc., exactly the way it will be printed. Inserting, deleting, centering, and justifying can be done on the screen without the need to print a work copy.

The real power and sophistication of a word processor is judged by how easy it is to use. **MAGIC WINDOW** is as easy to use as a standard typewriter, yet it has the POWER a PROFESSIONAL requires.

MAGIC WINDOW

LOOK INTO OUR **MAGIC WINDOW** AND EXPERIENCE A WONDERLAND IN WORD PROCESSING.

NO MATTER WHAT YOUR ABILITY, **MAGIC WINDOW'S** HUMAN ENGINEERING WILL GUIDE YOU FROM BEGINNING TYPING THROUGH PROFESSIONAL DOCUMENTS INSTANTLY AND EFFORTLESSLY.

• EDITING & FORMATTING

USING VERY SIMPLE KEY STROKES, **MAGIC WINDOW** WILL MANIPULATE PARAGRAPHS, MAKE ADDITIONS, DELETIONS AND CORRECTIONS. THE DAYS OF RETYPING ARE OVER.

• AFFORDABLE & EXPANDABLE

MAGIC WINDOW DOES NOT REQUIRE ANY MODIFICATION TO YOUR APPLE II COMPUTER. YOU CAN MODIFY **MAGIC WINDOW** TO USE ANY CUSTOM ADDITIONS YOU HAVE IN YOUR APPLE: LOWER CASE MODIFICATION, LANGUAGE CARDS, CUSTOM PRINTER INTERFACES ETC.

• HUMAN ENGINEERING

MAGIC WINDOW'S FOUR WAY SCROLLING ALLOWS YOU TO VIEW EIGHTY-COLUMNS ON YOUR FORTY-COLUMN SCREEN. MOST PAPER SIZES CAN BE SIMULATED. **MAGIC WINDOW** WILL SHOW ALL FOUR EDGES OF THE "PAPER" AS YOU TYPE. THIS SIMULATION OF A STANDARD TYPEWRITER HAS CAUSED A REVOLUTION IN APPLE II WORD PROCESSING.

MAGIC WINDOW WILL KEEP YOU SPELLBOUND WITH OUR SPELLBINDER—A WEBSTER'S WORD SPELLER/DIVIDER.

See your local dealer
or send cheques to :
SBD SOFTWARE
15 JOCELYN ROAD
RICHMOND TW9 2TJ
TEL :01- 948 0461
Telex : 22861



microware

MEMOREX FLOPPY DISKS

WHOLESALE PRICES FOR END USERS

MAIL
ORDER

5 1/4"	SINGLE SIDED	SINGLE DENSITY	£1.65
	DOUBLE SIDED	DOUBLE DENSITY	£2.10
8"	SINGLE SIDED	SINGLE DENSITY	£2.39
	DOUBLE SIDED	DOUBLE DENSITY	£3.45

LOW
LOW
PRICES

COVER CRAFT PLASTIC COVERS SOLD IN BOXES OF 10

FOR: MICRO's
PRINTERS
V.D.U.s
FROM £6.95 – £9.95

We also stock Wheels and
Mutli-coloured ribbons
For: Qume, Diablo, N.E.C.

FLOPPY DISK SUBSYSTEMS

Double density single sided drives with power supply and enclosure	
Single 5.25" Drives	£175.00
Dual 5.25" Drives	£295.00
Single 8" Drives	£395.00
Dual 8" Drives	£695.00

INCREASE THE LIFE EXPECTANCY OF YOUR FLOPPY DISKS

INDEXING SYSTEMS	
5 1/4"	£1.50
8"	£5.95
For use with our Polymer Plastic Boxes	

FLOPPY SAVER KITS	
5 1/4" Saver Kit	£7.95
Refill pack	£4.95
8" Saver Kit	£8.95
Refill Pack	£5.95

5 1/4" DISK STORAGE SYSTEMS	
* Capacity: _____	50 Disks
* Colour: _____	Smoke/Sand
* Construction: _____	Polymer
Plastic/3 partitions	
*** £14.95 ***	

8" DISK STORAGE SYSTEMS	
* Capacity: _____	50 Disks
* Colour: _____	Seville/Black
* Construction: _____	Polymer
Plastic/6 partitions	
* Carrying Handle	
* Lock and Key	
*** £24.95 ***	

Terms: payment with order in favour of Microware (London) Ltd.
Please add 15% V.A.T. and 50p Postage.
Telephone and Mail Orders accepted. Tel: 01-346 8452

Microware (London) Ltd., 5 Western Court, Huntly Drive, London N3 1NX



OFFER A GREAT DEAL & MORE

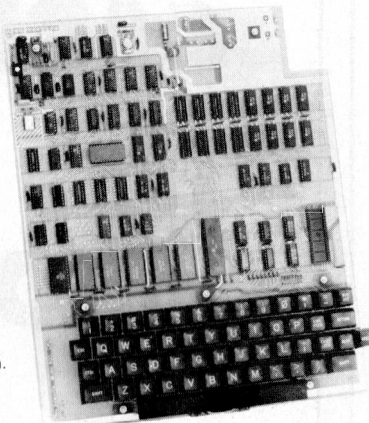
NEW SUPERBOARD SERIES II

Ready built & Tested

New from OSI - Series II. Everything series I had but with more on a single board. Ideal for the beginner or experienced engineer alike. It needs only a 5V 3A power supply to be up and running. Fully expandable to a Floppy Disc and small business system.

ONLY £149
+ P&P £3.50 + VAT

- 625 lines jitter free Display.
- Memory Mapped Video Display with upper/lower case graphics and gaming characters.
- Software selectable Display 24 x 24 48 x 12
- Uses the ultra powerful 6502 Micro.
- 8K Microsoft Basic in Rom.
- Full feature Basic runs faster than currently available computers and all 8080 based business computers.
- 4K static Ram on board expandable to 8K.
- Full 53 Keyboard with upper/lower case and user programmability.
- Power on reset-standard.
- 2 second action break key.
- Kansas City standard Audio cassette interface for high reliability.



- 6 latch outputs available for control purposes.
- 8 bit Digital to Analogue converter.
- Full machine code monitor and I/O utilities in Rom.

Superboard II Series II £149.00 + VAT
Black ABS case £ 24.50 + VAT
Extra 4K Ram £ 12.00 + VAT
PSU 5A Ready Built £ 23.00 + VAT
Numeric Key Pad Kit £ 11.95 + VAT
610 Expansion Board with 8K fitted (expandable to 24K) £150.00 + VAT
CD3P Floppy Disc £269.00 + VAT
WEMON £ 19.95 + VAT

Video swap tape FREE!

Series 2 User's Manual
The best single source of information £6.95, no VAT

WEMON The Definitive Monitor

Look at these superb facilities:

- Full screen editing.
- Fully programmable cursor control with meaningful symbols on screen.
- Single key Basic
- Auto remote control of tape recorder (requires only a relay).
- Open line facility.
- Named tape files.
- Cursor indication of quotes mode.
- Auto list on error (displays faulty line upon carriage return).
- Single command save (automatically returns "list").
- Centronics compatible printer driver.

INCLUDING Highspeed Cassette Save & Load

Monitor functions include:

- Scrolling list in data mode.
- Warm restart vector.
- Fill memory.
- Search memory.
- Two save and three load routines.
- Floppy disc vector.
- Tabular display of memory.

To order: Send £23.52 or phone your ACCESS number for same day despatch. State version required.

All this for only £19.95
+ 50p P&P + VAT.

SOFTY The complete microprocessor development system for the Engineer and the beginner alike

- Displays memory contents on standard UHF TV.
- Can replace monitor Rom to test and develop programs.
- Ideal training aid.
- Two 8-bit I/O ports.
- Fast cassette interface.
- On-board Eprom programmer.
- Copies software.
- Simple modification for single rail.

Price: Kit.....£ 99.00 + VAT
Ready built.....£120.00 + VAT
PSU.....£ 20.00 + VAT
P & P.....£ 1.50 + VAT

FREE 2716 with each Softy

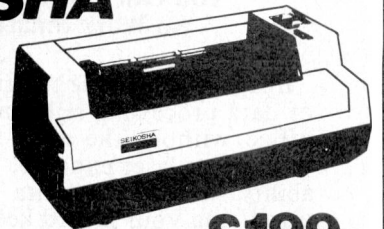
VIDEO GENIE A Complete Computer System

- 16K User Ram
- 12 K Microsoft Basic in Rom.
- 64 x 16 line Display
- 128 x 48 dot graphics resolution.
- Software compatible with TRS80 level II.
- Built in Cassette Recorder.
- Output and Control for Second Cassette.
- Full expansion via Expansion box to Disc-Printer

£289 P & P £5 + VAT

SEIKOSHA GP80A

This Unihammer dot Matrix Printer gives Normal and Double Width Characters as well as Dot resolution Graphics.



- Printing Speed 30 cps
- Character Set 5 x 7 Matrix
- Print Density 12 CPI at 80 CPL
- Paper Feed 8" Tractor
- Parallel Interface Standard

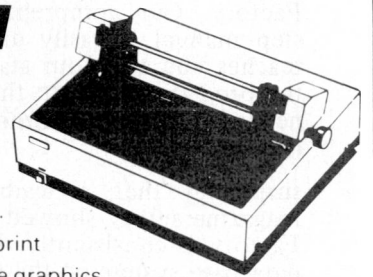
Other Interfaces
RS 232C £49 + VAT
IEEE 488 or
Apple £35 + VAT
Pet £35 + VAT

£199
P & P £4.50 + VAT

500 Sheets of paper FREE!

EPSON TX80

A complete 80 column dot matrix printer, available in tractor or friction feed versions.



- Speed: 125cps.
- Undirectional print
- PET compatible graphics.

500 Sheets of paper FREE! £235
Various Interfaces available from £35 P & P £4.50 + VAT

COMPUTER IC's

2114L-300n	160
2114L-200n	210
2532-32K	£10
2708	325
2732-450n	£10
2716-5V	330
4116	150
6752	675
6520	325
6522	570
6532	785
6545	1450
6551	785
6592	2572
6800	480
6802	595
6810	280
6821	315
6840	750
6850	315
6852	380
8080A	450
8085A	1100
81LS95	99
81LS96	99
81LS97	99
8212	210
8214	425
8216	200
8251	475
8253	999
8609	1550
8728A	160
8728B	160
8796N	160
8797N	150
AY-3-1015	420
AY-5-1013	375
AY-5-2376	750
MC1488	90
MC1489	90
MC14411	950
MC14412	£11
MK4027-2	450
RO-3-2513U	600
SF59654E	950
SFC71301	820
TMS4027	250
TMS6011	365
Z80CPU 2/5	600
Z80ACPU 4M	800
Z80 P10	550
Z80A P10	645
Z80 CTC	550
Z80A CTC	645
Z80 DART	£12
Z80A DART	£15

'D' CONNECTORS (Cannon type)

Plugs	Sockets	Covers plastic
9 way	90p	118p
15 way	120p	167p
25 way	180p	280p
37 way	268p	390p

DIL SOCKETS (TEXAS)

Low profile	Wire wrap
8 pin	10p
14 pin	10p
16 pin	10p
18 pin	16p
20 pin	22p
22 pin	25p
24 pin	30p
28 pin	35p
36 pin	—
40 pin	40p

EDGE CONNECTORS (TEXAS)

double type	1
2 x 10 way	82p
2 x 15 way	98p
2 x 18 way	140p
2 x 22 way	150p
2 x 25 way	165p
2 x 30 way	188p
2 x 36 way	197p
2 x 40 way	205p
2 x 43 way	250p

DIL PLUGS (Headers)

14 pin	44p
16 pin	49p
24 pin	88p
40 pin	249p

DIL switches

SPST 4 way	10 way
85p	175p
6 way	SPDT
8 way	4 way
115p	190p

JUMPER LEADS (Ribbon Cable Assemblies)

Single end DIP Jumpers length 24"			
14 pin	145p	16 pin	165p
24 pin	240p	40 pin	385p
Double end DIP Jumpers Length			
14	16	24	40
6"	185p	205p	300p
12"	195p	215p	315p
36"	230p	250p	375p

SPECIAL OFFER

	1+	50+
2114 - 450n	150p	128p
2114L - 300n	165p	135p
2114L - 200n	215p	185p
2532	£10	£8
2708	350p	295p
4027	250p	215p
4116	150p	110p

ACCESSORIES

TEX Eprom Eraser	£33	8" Fan-Fold Paper	
6Mhz Modulators	£2.80	500 sheets	£5.95
8Mhz Modulators	£4.50	9 1/2" Fan-Fold Paper	£5.95
STAKPAK 10 Cassettes	£5.50	500 sheets	£3.00
ASCII Keyboard 756	£40	TELEPRINTER ROLL	£65.00
		9" B & W Monitor	

ALL PRICES EXCLUSIVE OF VAT & CARRIAGE

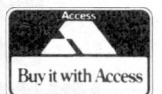
The above is just a selection of our vast stocks of brand new, full spec, electronic components. To Order: Please add 15% VAT to all orders unless stated. On orders of less than £10 add 40p P&P. Terms of Business: Cash/Cheque/P.O.'s or Bankers Draft with order.

Access Orders: Minimum £10 please.

Government, Education Authorities & Trade Welcome.

JUST PHONE IN YOUR ORDER WE DO THE REST.

33/35 CARDIFF ROAD, WATFORD, HERTS. Telephone 40588



WATFORD ELECTRONICS

micro lab we solve problems...

You Can't Work Harder,
So Work Smarter.

Imagine being able to bring the world of data processing right into your own office without the need for extensive training or large expense. You have the ability with "The Data Factory" of organizing your record keeping system. You decide what you want to keep track of, and easily develop solutions to your own problems. No need for a course in computer programming. You don't even have to know how to operate a computer to use The Data Factory. Our comprehensive step by step manual is easily understood and teaches you and your staff how to use the program to set up the systems you need—inventory, customer lists employee records

It is not surprising that a leading computer magazine survey showed that The Data Factory is consistently the best selling data base system on the market for the economical Apple micro computer.

Consumer Oriented.

Micro Lab's products have been sold to thousands of corporations. It is a name that you can rely on. Our Extended Warranty and customer service policies are the standard in the small computer industry. When you decide to buy a Micro Lab product, you can be assured that our system will work. For a minimum investment in this inexpensive computer system, your entire office will function smoothly and efficiently. Large corporations need not tie up their main computer with specialized office procedures—you can place one computer in each department, or tie a branch office into your system with a modem. You can't afford to be without our products.

Each product described above retails for £100. For further information about Micro Lab products, contact us directly or go to your local Apple computer dealer for a demonstration.

**Distributed Exclusively in UK
by
Personal Computer Ltd,
194-200 Bishopsgate,
LONDON EC2 01-626-8121**

micro lab

systems that work

3218 Skokie Valley Road
Highland Park, IL 60035 • 312-433-7550

© 1981, Micro Lab, Inc.
Apple is a trademark of Apple Computers, Inc.

BUSS STOP

BUSS
STOP

PROP: PHOTO ACOUSTICS LTD

**CASH and CARRY on
PET
APPLE
and
video genie**

58 HIGH ST
NEWPORT PAGNELL
BUCKS
TEL: (0908) 610625

255a ST ALBANS RD
WATFORD, HERTS
(entrance in Judge St)
TEL: 32006



UTILITIES

AOPT:

Applesoft Program Optimizer is a 2.2k machine language utility that will substantially reduce the size of the program without affecting the operation of the program **£19.95**

APLUS:

Applesoft-Plus Structured Basic is a 4k machine language utility that adds structured programming commands to Applesoft basic. For example 'DO CURVE-FIT' **£19.95**

CRAE:

A co-resident Applesoft Editor. Global changes & finds. Quote (copy) a range of lines. Append, Renumber, Modify, 15 commands in all **£14.95**

CRAE & MCAT:

Editor (as above) & MCAT which creates a sorted Master Catalog. **£19.95**

APPLE PROTECTOR III:

Protect your programs against pirating. The protected disks cannot be copied by presently available commercial copy programs. **£60**

SDC III:

Super Disk Copy III is a menu driven program that allows manipulation of all types of files under DOS 3.1, 3.2 & 3.3 COPY single files, DOS, entire disk, UNDELETE, FIX filesizes etc. Allow files to be transferred back to DOS 3.2 **£24.95**

DISK RECOVERY:

This utility will examine all the sectors on the disk, BAD BLOCK SCAN option. And the REDO VTOC option may correct "messed-up" disks. Repair your disk. **£24.95**

DOS PLUS:

This utility adds 8 new commands to APPLE DOS. Three are built-in & 5 are user-definable. Now you can 'flip' between DOS 3.3 & DOS 3.2 while a program is running!! **£19.95**

Add 15% V.A.T. Postage & Packing Free.

Write or phone for full catalogue of available software.
Dealer Enquiries Welcome.

Contact: - S.B.D. SOFTWARE, 15 Jocelyn Road
Richmond TW9 2TJ Tel: 01-948 0461 Telex: 22861



INTERFACE SOFTWARE



Now for floppy and hard disks, single and multi-user microcomputer systems.

3,000 SALES
a/c's



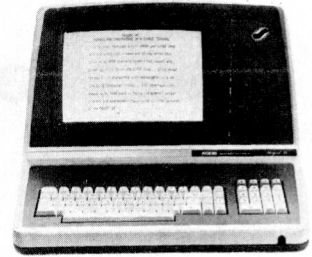
STOCK 20,000
items



PURCHASE 3,000
a/c's



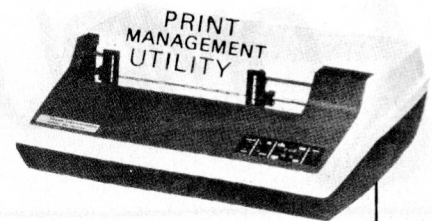
PAYROLL 500+
Personnel



NOMINAL 3,000 a/c's



Special update prices
for Release 1 Users



- Nominal Ledger Accounting Transfers
- Stock integration on Invoicing with Stock Update
- CP/M and MP/M operating systems
- Full Audit Trails
- Inbuilt Training and diagnostic aid
- Free 24hr problem solving service
- Hard or Floppy Disk systems
- Multi-Tasking
- Print Management Utility
- Distributor/Dealer enquiries welcome
- Dealer Demonstration Packages

VAT ANALYSIS

SALES ANALYSIS

INVOICE

CREDIT NOTE

TRANSACTION

REPORT

CASH

REQUIREMENTS

INVENTORY

UPDATE REPORT

PROFIT
& LOSS a/c

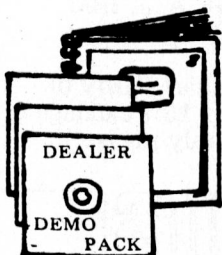
TRIAL BALANCE

AGING REPORT

COST OF SALES

ETC.,

ETC.



INTERFACE SOFTWARE BUSINESS PACKAGES

THE HARDWEARING SOFTWARE

100 Park Street, Camberley, Surrey, GU15 3NY

(0276 27982)

ROMFORD COMPUTER SHOP

Presents

The ACORN ATOM

With

paddles - printers - monitors - games

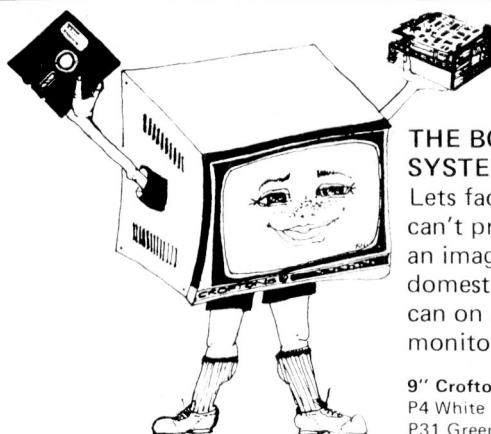
Plus

ram - colour encoder - magicbook

COMPUSKILL

72 North Street,
Romford,
Essex.

Telephone Romford 751906



THE BODY OF ANY SYSTEM

Lets face it — you can't produce as crisp an image on a domestic T.V. as you can on a Crofton monitor.

9" Crofton Monitors	
P4 White	£64.97
P31 Green	£77.62

SHUGART FLOPPY DISK DRIVES

No case, No Power Supply

SA 400	5¼"	S.S.S.D.	£149.05
SA 450	5¼"	D.S.S.D.	£283.31
SA 800	8"	S.S.S.D.	£340.52

FLOPPY DISKS — BOXES OF TEN

Single sided	35/40 Track	£ 26.45
Double sided	35/40 Track 5¼"	£ 37.95
Single sided	77 Track	£ 41.40
Double sided	77 Track 5¼"	£ 47.15
Single sided	8"	£ 40.25

IKGAMI 12" MONITORS

P 4 White	£171.50
P31 Green	£184.97

2/3" FULLY INTERLACED C.C.T.V. CAMERAS £149.00

ALL THE ABOVE PRICES INCLUDE V.A.T. AND CARRIAGE



ALL MAJOR CREDIT CARDS
ACCEPTED — Small surcharge



CROFTON ELECTRONICS LTD

35 Grosvenor Road, Twickenham, Middx TW1 4AD
01-891 1923/1513

IBM SELECTRIC GOLFBALL PRINTERS AND INPUT, OUTPUT 735 TYPEWRITERS

PRINTERS FROM	£195.00
735 TYPEWRITERS FROM	£245.00
WIRING AND COMMISSION	
TO SUIT ACULAB INTERFACE	£48.00
ACULAB INTERFACES EX STOCK	£155.00

ALSO AVAILABLE

IBM 71, 72, 82 typewriters.
Full workshop facilities for rebuilds and servicing.

Keyboard ASCII-ASCII, 10-12 pitch, language conversions undertaken.

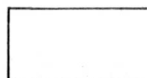
11", 13", 15" platen lengths, split platens pin feed platens. Operational keylever repeats fitted on request.

Full IBM range of 10-12* pitch heads including language, symbol and metric.

Language keybuttons blue or grey

WE BUY SELL OR EXCHANGE ALL IBM
SELECTRIC TYPEWRITER MODELS

For further details phone Stuart Kirby or
Louis Baker Prices excl VAT @ 15% carriage &
packing, callers by appt only please

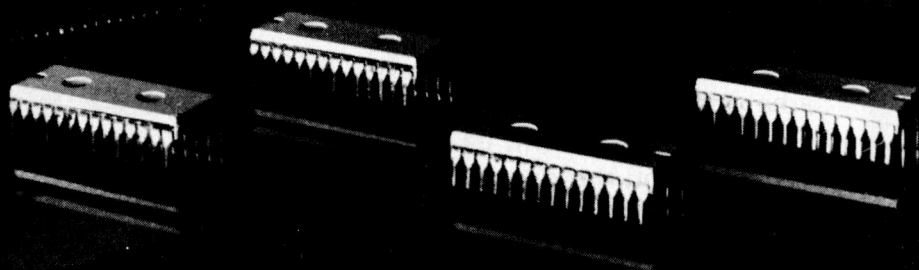
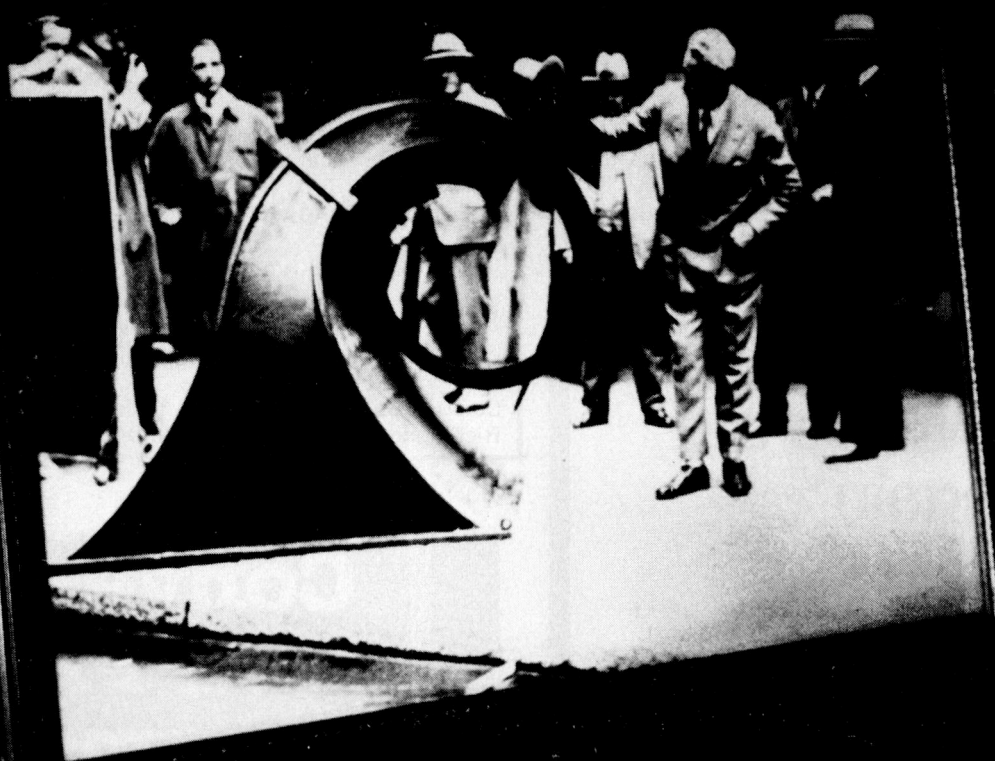


KEYTRONICS



Saul Lodge, Saul, Gloucester GL2 7JE
Tel: 0452 740 612

THE TALKIES COME TO TOWN



In the Twenties, talking pictures came to the cinemas of Europe. Sixty years later Hi-tech Electronics presents an evaluation board which brings talkies to the computers of Europe.

£185 brings you an S100 computer card, with a chip set preprogrammed with 144 words (spoken in English not Dalekese) and incorporating the natural inflection and emphasis of the original speech. Getting the board to talk is simplicity itself – just send the number

corresponding to the required word, and the electronics does the rest.

Delivery is currently from stock. If you require further details, please call or write to

HI-TECH ELECTRONICS

54 HIGH ROAD, SWAYTHLING, SOUTHAMPTON SO2 2JF
TEL 0703 581555 TELEX NO 47388 HTL

tomorrow

Tomorrow is here and micro-computers may never be the same again

Think of a 48K, 8" Twin Disk Based System, complete with VDU, Printer, Software and Manuals.

Now think of a price.

How does **£2790.00** (Ex. VAT) sound.

Now think of it installed, tested and running anywhere in the U.K. for the same price.

Interested, then ring **0473 823698** and we'll send you the details.

Tomorrow still has vacancies in some areas of the U.K. for additional independent sales agents. Please write or telephone for further information.

TOMORROW MICRO-SYSTEMS

Number One Queen Street, Hadleigh,
Ipswich, Suffolk.

Telephone: 0473-823698

Telex: 987669

A member of the Kioxmas Group



GAMES

Hi-Res SOCCER:

The only real-time action SOCCER game for Apple. All tackling, goal kicks, throw-ins, corners, are shown in full Hi-Res graphics. Fully animated players. **£22.95**

Alien Rain:

The Aliens swoop down from all sides in swift attack. Formerly sold as Apple Galaxian. **£12.95**

Snoggle:

You are Snoggle, wending your way through a maze of ghosts who will eat you if they catch you. You must be quick & bold. Please note, the upper levels of this game are very difficult.. **£12.95**

Space Eggs:

A terrific arcade-style game. You will be hatching little spiders, wolves, lips & fuzzballs!!! **£14.95**

The Wizard & the Princess:

In this adventure you must do battle against an evil wizard to save the life of the Princess. **£17.95**

Tarturian:

As you explore 160 rooms you gather weapons & treasure for the final battle against the Tarturian. **£14.95**

Creature Venture: You have inherited your Uncle Stashbuck's mansion. You must rid it of the horrible creatures to find your uncle's buried treasure. **£14.95**

THE GALACTIC SAGA:	The Galactic Empire I	£12.95
	The Galactic Trader II	£12.95
	The Galactic Revolution III	£12.95
	Tawala's Last Redoubt	£14.95

Add 15% V.A.T. Postage & Packing Free

Write or phone for full catalogue of available software.

Dealer Enquiries Welcome.

Contact: **S.B.D. SOFTWARE**, 14 Jocelyn Road,
Richmond TW9 2TJ Tel: 01-948 0461, Telex: 22861

Convert your PET to a terminal for £180!

Why spend £4000 on a terminal when you can convert your Commodore PET for only £180 to do exactly the same thing?

Kingston offer you this with NETKIT — a hardware/firmware package which dramatically widens the scope of the PET, and maintains Kingston's reputation as market leaders in computer communications and interfaces.

● Netkit allows the PET to link to any RS232 Device,

including another PET, micro, most mini and main frame computers.

● Easy to use, no complicated machine code for input.

● Gives automatic character conversion.

Useful in programming and linking to paper tape punches, instrumentation and control devices.

● Can be used as a normal printer interface.

● High speed transmission via RS232 and not IEEE.

● Detailed manual, cable corrections and supporting software also included.

Hundreds of NETKITS have well documented operational reliability in numerous applications. Find out more for yourself, just send for further information on NETKIT and other Kingston products: Once you've seen our leaflet you may wish to take up our 30 day sale or return offer. We are sure you'll be convinced.



KINGSTON

Kingston Computers Limited, Electricity Buildings, Ffiley, Yorkshire, U.K.
Telephone: 0723 514141 Telex: 52163

TRANSAM COMPUTER SYSTEMS

THE TUSCAN S100 MICROCOMPUTER SYSTEM

Designed, built and supported in Britain by TRANSAM, the Tuscan S100 system is an economical and very powerful computer system, designed to be used in several configurations dependent of user requirements.

Using the Z80 processor, it is CP/M compatible with S100 expansion onboard. If that doesn't mean much to you now, then rest assured that it will when it comes to ease of expansion and software availability. An ideal system for use at home, in the office, at school, in the lab or in development applications, TRANSAM take care of all your requirements. Our new systems catalogue covers the Tuscan and a whole range of computer hardware now available.



DESK TOP S100 SYSTEMS TO SUIT YOUR NEEDS

We support the S100 bus! Our experience in microcomputer design and development enables us to support a whole range of computer hardware, to help and explain systems and to offer the level of support you can only get when dealing direct with the manufacturer.

We have laid out in our new systems catalogue all you need to know about choosing your hardware, how to choose the right printer and the size of disc drive, and what future expansion to consider. Our advice is free and our systems are very competitive.

Even if you don't have an S100 system, our catalogue has something of interest to everyone. Send for your copy now, or better still call in and see us and collect your copy from our London showroom. We sell direct and by mail order worldwide.

SOFTWARE

TCL SOFTWARE — A DIVISION OF TRANSAM

TCL Software specialize in producing British software for the British market. We have several major software packages to our credit, the most famous being TCL Pascal, our own British Pascal compiler. It was originally produced to run on our own Triton and Tuscan computers, but is now available as a standard CP/M package and for the CBM PET computer, officially marketed by Commodore worldwide. An example of British software at its best.



SOFTWARE PACKAGES TO SUIT YOUR APPLICATIONS

We have compiled a new software catalogue primarily aimed at CP/M users. This lists all the applications packages we have available, several languages and plenty of interesting program development aids. It's hard to think of an occupation for which a micro would not be an aid. Software is continually being developed and improved for use in almost every professional field. With good advice you can choose the right package to suit your application. Our software catalogue has something for all.

AND SPARES

MICROCOMPUTER SPARES AND ACCESSORIES

Have you ever had problems getting the right connector or replacing a faulty interface cable? Have you ever thought you could do a better job if you could only get the right spare parts?

We specialize in microcomputers and stock a comprehensive range of components and spares: memory and support chips; microprocessors; TTL logic; and all those hard to get connectors and cables.



PROTOTYPING AND DEVELOPMENT SYSTEMS

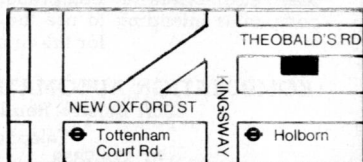
Fast, return of post mail order service on all our products. Telephone credit card orders accepted or call at our showroom. All our products are brand new and fully guaranteed. From prototype through to production our range of microcomputer products will cover your requirements. Hobbyist, school, university, R & D or OEM. Send for our new components catalogue.

... three new catalogues

TRANSAM

NOBODY DOES IT BETTER!

Transam Components Ltd
59/61 Theobald's Road
London WC1
Tel: 01-405 5240/2113
Callers welcome



Three new catalogues available from Transam, the British microcomputer specialists. Catalogues are 40p each or all three for £1 (free to government departments, schools and companies). Please send large (A4) SAE.

- Please send me the computer systems catalogue ☐
- Please send me the software catalogue ☐
- Please send me the components and spares catalogue ☐

NAME

ADDRESS

TELEPHONE

Professional Data Systems.



Carne House, Markland Hill,
Chorley New Road, Bolton.
0204 493816

**LEVEL I APPLE ACCREDITED SERVICE
DEALER ONE YEARS FULL WARRANTY
ON ALL APPLE EQUIPMENT. DEALER
ENQUIRIES WELCOMED.**

*RING FOR OUR COMPLETE CATALOGUE
ALL PRICES SUBJECT TO 15% VAT +
POSTAGE & PACKING CREDIT CARD
SALES SUBJECT TO 5% CHARGE OVER
ADVERTISED PRICE. WE NOW
DISTRIBUTE FOR SIRIUS, MICROSOFT,
STONEWARE HIGH TECHNOLOGY
CREATIVE COMPUTING*

DATABASES

D.B. MASTER A total of 9 Screen Pages per record
with up to 1020 bytes per record & 100 fields. This is
THE database. Rave reviews in U.S.A. £109.95

INFORMATION MASTER From High Technology.
One of the better systems available for Apple. £73.95

D.M.B.S. Also from High Technology. Lower cost system
for those on a tight budget. £49.95

DATA MASTER A must for purchasers of High
Technologies data bases. Allows redefinition of fields
& transfer of data £49.95

WORD PROCESSING

WORD STAR is regarded as the best word processor
on the market for the small computer. All functions of
a sophisticated w.p. available. Additional hardware
requirements are Z80 & 80 col. cards. This is the same
programme other suppliers are offering at £300 + £195.00
APPLEWRITER Simple easy to use text editor complete
with manual £35.00

PLUG IN CARDS
PASCAL LANGUAGE £250.00

INTEGER CARD £99.00

80 COLUMN CARD 80 col x 24 line with upper and
lower case-true descenders. £165.00

Z80 SOFTCARD Allows implementation of CPM
software £175.00

16K RAMCARD Expand the c.p.u. on the Apple
up to 64k. £110.95

HARDWARE

APPLE 16k An unbeatable price from one of the
leading suppliers of Apple Business systems. We are a
Level 1 Service Dealer with full support capabilities for
all hardware supplied by us. £595.00

DISC DRIVES 5¼ inch Apple Drives £265.00

CONTROLLER £75.00

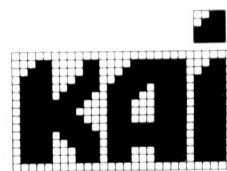
12" GREEN/BLACK MONITOR Exceptionally clear
screen. The best we have seen With cable £154.00

GAMES

The following are just a brief selection of games we stock.
We have a permanent Apple set up for visitors who want
to test products before purchase. Telephone to make
appointment to visit our showroom.

TOP TEN SELLERS

SPACE EGGS	£14.95
ADVENTURE	£14.95
ASTEROIDS IN SPACE	£12.50
A.B.M.	£16.00
APPLE GALAXIAN	£13.95
PUCKMAN	£16.00
HELL FIRE WARRIORS	£15.50
TEMPLE OF APASHAI	£15.50
FLIGHT SIMULATOR	£20.00
STAR CRUISER	£13.00



KAI Starter Pack

Apple II Europlus 48K, Disk Drive with Controller (DOS 3.3),
Epsom MX80, 9" Hitachi Monitor and 'Using your Apple
course' by Little Genius. Ref S1
£1549.00

Apple II Europlus 48K, Disk Drive with Controller (DOS 3.3),
Disk Drive, Paper Tiger 445 with Interface, 9" Hitachi Monitor
and Pack of 3 Little Genius Courses. Ref S2
£2079.00

KAI Business Pack

Apple II Europlus 48K, Disk Drive with Controller (DOS 3.3),
Disk Drive, 12" Green Screen Monitor, Paper Tiger 445 with
Interface, Pack of 3 Little Genius Courses, Visicalc, Desk Top
Plan II, Appleplot, Applewriter and Hi-Tech Information
Master. Ref B1
£2449.00

Apple II Europlus 48K, Disk Drive with Controller (DOS 3.3),
Disk Drive, 12" Green Screen Monitor, Olympia Scripta Letter
Quality Printer/Typewriter. Double Vision 80 Column Display
and Serial Interface, Visicalc, Desk Top Plan II, Format 80
Word Processor System, Hi-Tech Information Master. Ref B2
£3099.00

KAI Financial Planning/Modelling Pack

Apple II Europlus 48K, Disk Drive with Controller (DOS 3.3),
Disk Drive, 12" Green Screen Monitor, Paper Tiger 445 with
Interface, PASCAL Language System Micromodeller,
Visicalc, Desk Top Plan II, Appleplot, Hi-Tech Information
Master and Applewriter. Ref F1
£2999.00

Apple II Europlus 48K, 2 x Disk Drives with Controller (DOS
3.3), Disk Drive, 12" Green Screen Monitor, Pascal Language
Systems, Double Vision 80 Column Display Card, Serial
Interface, Qume Sprint 45RO Daisy Wheel Printer,
Micromodeller, Visicalc, Desk Top Plan II, Appleplot, Hi-
Tech Information Master, Format 80 Word Processing System
Ref F2
£4599.00

Accounting Software

TABS Accounting System for sales, purchase and nominal
ledgers, stock control, job costing, payroll, order processing,
invoicing, mailing list, sales order processing and word
processor.
£99.00 per module.

Foundation module available from us at £89.00.

KAI Progress Pack (Upgrades your existing 48K Apple II with
2 Disk Drives DOS 3.3).

Upgrade your system to business standards with letter quality
capability (see Business Pack above). 2 Olympia Scripta,
Format 80, Double Vision 80 Column Display Cards, Serial 1.
Ref FU1
£1399.00

Financial Planning/Modelling Upgrade, PASCAL Language
System, the popular Micromodeller and Disk Drive with
Controller. Ref U2
£949.00

KAI Over-the-Counter Service

- ★ Bank Draft, Cheque or Money Order only accepted
with order
- ★ All prices quoted are exclusive of VAT and Delivery
- ★ Collections by appointment only
- ★ Allow 30 days for delivery
- ★ Warranty for Apple products — 1 year
non-Apple products — 90 days
on a return to supplier basis
- ★ Offer subject to availability

For a comprehensive list of our software and accessories
competitively priced for our Over-the-Counter Service Write
or Telephone NOW!

KAI Professional Service

KAI also offers a comprehensive business service for
companies intending to use the microcomputer applications
for the first time.

KOMPUTATION AUTOMATION INFORMATION LTD

203A Belsize Road, London NW6

Telephone

01 328 7038 01 328 3968

24 hour personal answering service 01 486 4808

apple[®] II PLUS

© Apple is a trade mark of Apple Computer Inc., Cupertino, CA. USA.

Sales and Service



WE SUPPLY THE COMPLETE
RANGE OF APPLE PRODUCTS
-AT OUR USUAL LOW PRICES

For full details
Contact :

Open Saturday
(All Day)

London Office
Opening Soon

Authorized Apple Dealer

GUESTEL

We supply all Apple products at competitive prices
For Free Advice

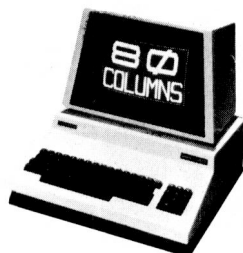
Telephone: 0273-695264

15 GRAND PARADE, BRIGHTON, SUSSEX, BN2 2QB

TOMORROW TODAY at Birmingham Computer Centre

Commodore official distributors

New
low
price



8032
£825

12 months
warranty

4008-16-32 PETs
-8032 -8050

The reliable value for money system
with after sales support, instruction
and training facilities and a wide
range of programmes.

New
low
price



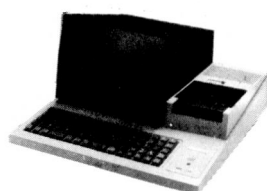
12 months
warranty

48K
Disk
drive with
controller
£1075
+ VAT

Apple authorised distributors
The sophisticated quality system with
a reputation for advanced design and
innovation.

New
low
price

SHARP
Z80K



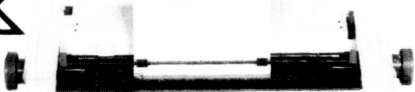
20K
£410

12 months
warranty

The incredible computer system.
Now available ex-stock including the
new dual drive double sided
floppy disk.

THE ULTIMATE IN DAISYWHEEL PRINTERS
RICOH RP 1600

New
low
price



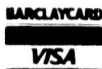
THE BEST WORLD PROCESSOR
PRINTER AVAILABLE
DEALER ENQUIRIES WELCOME

Unbeatable
value



Camden Electronics Ltd.
462 Coventry Road, Small Heath,
Birmingham B10 0UG.
Telephone 021 773 8240

Open Mon.-Sat. 9.30-6.00 p.m.



A MEMBER OF THE COMPUTER RETAILERS ASSOCIATION



Axon

PO Box 12,
Bentham
Lancaster
Phone:
(0468) 61848

AUTOACCOUNTS — an integrated accounting system with invoicing, journals, nominal & personal ledger and analysed cashbook (bank, cash, VAT & analysed net). Disk only £225. + VAT.

ANALYSED CASHBOOK — the core of the system. Item, Cheque No., VAT Rate, Bank, Cash, Vat, Net & Account. Auto Vat calculation & Totals for each page. Autoselection of nominal & personal items for posting to Ledger. £75 + VAT

LEDGER/STATEMENT — Dual purpose program creates Ledger for each Account, balancing when you wish. Also provides a Statement for customers. £25 + VAT.

INVOICE — Formatted Invoice with Item, Debit, Vat, Vat Rate, Net and Account columns & Totals. £25 + VAT.

DATASTAX — all purpose utility for transferring data: keyboard/tape/disk/video/printer in any logical direction. Disk not needed. On tape or disk. £15 + VAT.

EASYWORDS — easy to use word-processor, justification, block tab & single line tab, enhanced lines option, variable column width, title centering. £15 + VAT.

Programs are written for 32K/16K CMB PET, CBM Disk or Computhink or Tape, CBM Printer or Teletype etc. Please state which combination. Add 15% VAT.

APPLE SOFTWARE

The Wizard and the Princess — Hi-res adventure in 21 colours.	£18.95	M48K
Mystery House — Hi-res adventure using over 100 pictures.	£13.95	M48K
Oldorf's Revenge — Hi-res adventure with 100 rooms.	£11.95	A48K
Tarturian — Yet another hi-res adventure with 160 rooms.	£14.95	A48K
D/DATABASE — Ultra-fast database using advanced program techniques.	£39.95	A48K
DDA FILES CONTROLLER — Sorts and manipulates D/DATABASE files.	£39.95	A48K
Alien Rain (Galaxian) — Colour + hi-res version of pub game.	£13.95	M48K
Cyber Strike — 3D hi-res action adventure in space.		
MIND BOGGLING.	£21.95	M48K
Both Barrels — 2 hi-res action games on one disk.	£13.95	A48K
Star Cruiser — Real-time hi-res action game with sound.	£13.95	M32K
Mission: Asteroid — Hi-res adventure in 21 colours. Relatively easy.	£10.95	M32K
Hi-Res Soccer — English football for 1 or 2 players in hi-res.	£21.95	M48K
Missile Defense — Hi-res animation and sound arcade game.	£16.95	M48K
Thrilogy — Three super games on one disk.	£13.95	I48K
Warp Factor — 1 or 2 player hi-res Star Trek/Space War game.	£23.95	A48K
Cartels & Cutthroats — Business game for up to 6 players.	£23.95	A48K
Asteroids in Space — Superb hi-res implementation of the pub game.	£10.95	M48K
Fracas — Graphics and sound effects in this multi-player adventure.	£13.95	M48K
Alien Typhoon — A much more difficult version of Alien Rain.	£13.95	M48K
Demon Derby (Hyper Head-On) — 4 skill level hi-res car race game.	£13.95	M32K
Galaxy Wars — Colour graphics + Sound effects + hi-res.	£13.95	M32K
Snoggle (Puckman) — Hi-res maze of ghosts. Great fun.	£13.95	M48K
Hi-Res Cribbage — The title describes it. Even hear the pegs move.	£13.95	M48K
SuperScript — Word processor with true upper/lower case on screen.	£49.95	M48K
Phantoms Five — 3D action-packed hi-res game.	£16.95	M48K
Space Eggs — Hi-res super fast arcade style game.	£16.95	M48K
Pulsar II — 2 games on one disk.	£16.95	M48K
Orbitron — Fight off enemy forces and avoid meteor showers.	£16.95	M48K
Autobahn — Road race game with sound and hi-res graphics.	£16.95	M48K
Torpedo Fire — 3D hi-res World War II submarine simulation.	£35.95	A48K
Operation Apocalypse — Hi-res World War II wargame.	£35.95	A48K

A: Requires Applesoft in Rom. I: Requires Integer Basic. M: Will run on any Apple. All software is available on disk only and boots under DOS 3.2 (Some programs will also boot under DOS 3.3).

Many of the games require paddles. Please write or telephone for your FREE copy of our catalogue of Apple software. Prices include VAT @ 15%. Please add 50p P + P for orders under

£30.00 totally. DEALER ENQUIRIES INVITED. MAIL ORDER ONLY.

SPIDER SOFTWARE

98, AVONDALE ROAD, SOUTH CROYDON, SURREY.

Tel: 01-661 2365

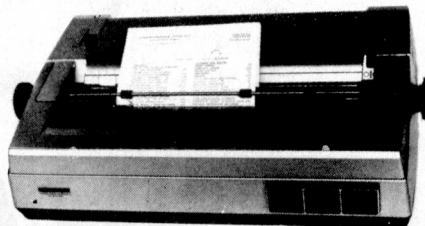
LONDON COMPUTER CENTRE

DAISY WHEEL PRINTER II INCLUDING BI-DIRECTIONAL TRACTOR
EXCELLENT PRINT QUALITY – SUPERIOR TO MOST FAMOUS MAKES

£1095

+ Built in proportional spacing + Look-ahead logic

**60 CHARACTERS PER SECOND
THE FASTEST DAISY WHEEL PRINTER.**
FAST, heavy duty commercial DAISY WHEEL printer, with high quality printout, coupled with low noise necessary for office environment. 124 char: upper/lower case. * 10/12 chars per inch giving 126 or 163 columns. * 15 inch wide friction platen. * BOLDING, underline, and host of other features. * Centronics type parallel interface as standard options: serial interface £60. * PET interface £65. * APPLE interface £75.



OPTIONAL EXTRA SHEETFEEDER £550

- ← TRS 80 Model I & II
- ← SUPERBRAIN
- ← APPLE
- ← PET
- ← HORIZON Etc

TRACTOR FEED O/E £175
SHEET FEEDER OPTIONAL EXTRA £550
JAPANESE RELIABILITY
Dealer enquiries invited

Other

Daisywheel printers
Qume RO £1,550
Qume KSR £1,695
Nec Ro £1,550

90 day on site warranty
on qumes included

Epson Mx100 F/T

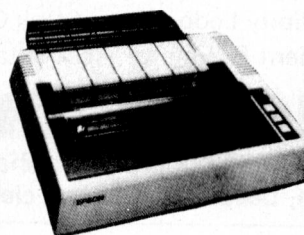
The only full 15" width
platen dot matrix
printer with dual print
modes.
Correspondence quality
and standard
Dot matrix £575

Full specification as
mx80. F/T, as right

EPSON MX 80 £395

WITH
DUAL PRINT MODES
+ ROLLER ATTACHMENT

CORRESPONDENCE QUALITY
AND STANDARD DOT MATRIX
IN ONE LOW COST UNIT



LETTER LIKE PRINT QUALITY
3-WAY PAPER HANDLING

1. Letterheads or A4
2. Fanfold
3. Paper Rolls

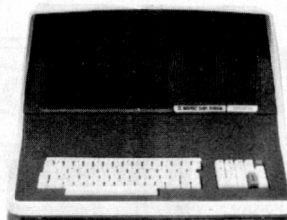
LOW NOISE
The quietest dot Matrix Printer
132 COLUMNS PER LINE
Directly replaces big, expensive
printers,
eg: Texas 810, Centronics 700
HIGH RELIABILITY
Precision engineered by Shinsu
Co. a subsidiary of Seiko Watch
Co. of Japan



**TRS-80
MODEL II**

State of the art second generation computer.
Over 10,000 already sold in USA, 8 slot
bus ensures expansion of hard discs & other
peripherals., 76 Key professional keyboard,
self test on power up, TRSDOS & Level
III basic standard. CP/M available as option.
making a wide range of accounting,
educational, scientific & word processing
packages instantly usable.
Nationwide service through 180 Tandy
stores & computer centres.

NOW WITH CP/M 2.24 £1999



SUPERBRAIN

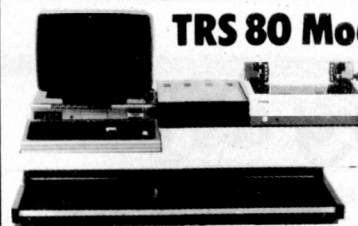
350K £1695

700K £1995

1600K £2595

**64K RAM Standard on
all models**

**NOW with MULTICOLOURED DEDICATED
KEYS for MAGIC WAND, the ULTIMATE
WORD PROCESSOR**



TRS 80 Model I

NEW LOW PRICES

48K System with dual
disk drives £1175
with Epson Printer £1350

New green screen VDU with rock steady
display. Redesigned 32K expansion inter-
face with trouble free operation & two
40 track disc drives.
16K Keyboard with Modulator £382
16K System: Keyboard, £485
Green screen & cassette
Dual 40 track disc drives & cables £425
32K Expansion Interface £299

VISICALC for TRS-80 MODEL 1 £52

CPM SOFTWARE

Wordstar	£250.00
Wordstar + Mailmerge	£315.00
Magic Wand	£250.00
Data Star	£195.00
T/Maker (similar to Visicalc)	£175.00
Report Writer	£90.00
Accounts Packages	from £295.00
Payroll	from £295.00
CBasic2	£75.00
MBasic80	£150.00
MBasic Compiler	£195.00
Pascal/M	£195.00
Pascal/Z	£155.00
Cobol	£325.00
CP/M	£95.00
Fortran	£205.00
Superpostman	£125.00

SOFTWARE FOR TRS-80

Electric Pencil (Disc)	£60.00
Electric Pencil (Tape)	£35.00
Scriptsit (Disc)	£75.00
Scriptsit (Tape)	£60.00
Mailmerge for Pencil	£45.00
VAT Aid Programme	£45.00

Apple 48K £805

Dual 35 track disk drives including
integral power supply 3.2/3.3
controller £650

As above 80 track drives 655K
total with 3.3 controller (equal to
5 Apple drives) £795

12" green monitor £89

**DEALER ENQUIRIES INVITED ON ALL
PRODUCTS**

Special LCC System 48K Apple,
dual 35 track disk drives 12" green monitor £1395

Double Vision 80 x 24 card £170

CPM Softcard £175

16K RAM (integer) card £95

CENTRONICS PARALLEL CARD £75

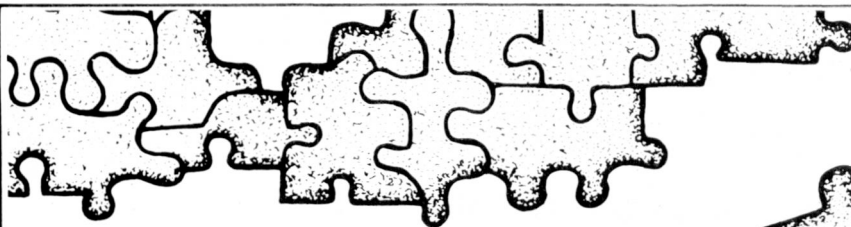
Serial Printer Communications card £85

All prices exclusive of carriage & VAT

43 GRAFTON WAY, LONDON W1P 5LA (Opposite Maples)

Tel: 388 6991/2 OPENING HOURS: 11-7 MON-FRI 12-4 SA 1

24 hour answer phone: 01-388 5721



If you are puzzled by the lack of good application software for CP/M micros; then puzzle no longer. - Ask about

We are exclusive distributors for UK of SERENDIPITY SYSTEMS packages for Apple & CP/M; of MAGSAM index sequential access routines for CBASIC and MBASIC and IFO-Information File Organiser - the best data base package available for use with Apple.



DATAFLOW

The easy-to-use, fast and flexible Data Base Management and Information Retrieval package.

Also ask about; Inter-Stat, Advanced Maths and Video Message packages for Apple
Ask for leaflet on; Serendipity Ledgers and Stock Control for CP/M
Professional Client Billing for Accountants, Lawyers etc.

GREAT NORTHERN

Computer Services Limited

55 East Parade, Harrogate, HG1 5LQ Telephone [0423]501131 Telex 57453 For Great Northern
116 Low Lane, Horsforth, Leeds LS18 5PX. Telephone (0532) 589980



Try us!

*MEMORIES

2732	32K EPROM	(4x8)	450ns	£6.25
2532	32K EPROM	(4x8)	450ns	£6.25
2716	16K EPROM	(2x8)	450ns	£3.50
2708	8K EPROM	(1x8)	450ns	£2.80
2114	4K S RAM	(1x4)	450ns	£2.00
2114	4K S RAM	(1x4)	300ns	£2.20
2114	4K S RAM	(1x4)	200ns	£2.30
4116	16K D RAM	(16x1)	200ns	£1.25
5101	1K C MOS	(256x4)	450ns	£1.20
6504	4K C MOS	(4x1)	250ns	£3.50
	16K C MOS RAM	(2x8)	250ns	£13.00

*LOGIC IC's

74LS09P	£0.13	LS174P	£0.42
LS48P	£0.36	74LS175P	£0.42
LS90P	£0.33	LS257P	£0.48
LS138P	£0.30	LS367P	£0.33
LS163P	£0.65	LS368P	£0.33

*CMOS

4001	£0.14	4049	£0.19
4011	£0.14	4081	£0.14

*EPSON PRINTER

MX70, TX80B EX STOCK

Please add 50p for postage and packing for orders under £50.
Prices include VAT. Minimum order £15.



Calona Limited

Third Floor Broadway House
112-134 The Broadway Wimbeldon
London SW19 1RH
Telephone 01-543 1008 Telex 923416 CLNLDN G

LOOK

NASCOM USERS

YOU CAN HAVE A DUAL DRIVE SYSTEM
FOR LESS THAN £300

Based on the highly reliable Philips Mini Cassette Drive ..

• Uses the powerful Z80 SIO

• Faster than stringy floppy

• Highly Structured Command Set

Includes Catalog / Transfer / Jumps, etc.

Single drive kit £230

Dual drive kit £299

Send sae for details.

C.I.E.L.

COMPUTER INTERFACING & EQUIPMENT LTD.

46. MOREDUN PARK
GARDENS.
EDINBURGH, EH17.
TEL 041 221 3399

NAME
ADDRESS

ANGLIA COMPUTER CENTRE

MICROCOMPUTERS FOR BUSINESS,
EDUCATION AND HOME

FOR ALL YOUR BUSINESS, EDUCATION & LEISURE
COMPUTER REQUIREMENTS!!!

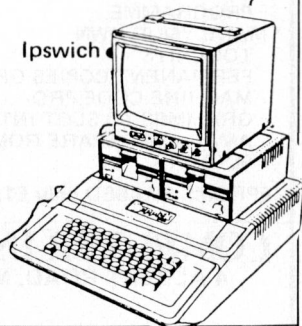
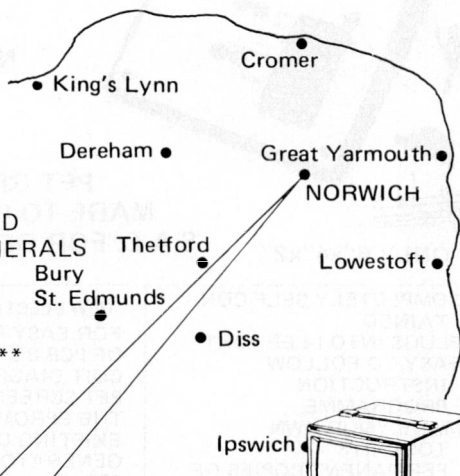
APPLE II
TRS-80
SHARP
NORTH STAR
HORIZON
TANGERINE
J.K. 101
NASCOM

+PRINTERS AND
OTHER PERIPHERALS
BOOKS**
SOFTWARE*
MAGAZINES**
STATIONERY***

BUSINESS+
INDUSTRIAL
CONTROL

WE ARE HERE!!!

88 St. Benedict's Street
NORWICH NR2 4AB
Tel. (0603) 29652
24hr. Answering Service.



COMPUTERS

From as little as £20 per week for your own business system
with video screen, keyboard, twin floppy disk unit and printer.
Choose any of the software programs available i.e.:

- * Word processing
- * Payroll
- * Invoicing
- * Stock control
- * Book-keeping
- * Incomplete records
- * Time recording
- * Information retrieval
- * Cash flow
- * Projection analysis

And when you've finished your easy days work we've got a few
games for you to relax to including Space Invaders.
We have first hand experience in dealing with businesses and can
offer you expert advice in setting up your very first system.
We can also offer installation, training and maintenance contracts.

NOW IS THE TIME

EXTRAS & OPTIONS
Floppy disks
Continuous Stationery
Dustcovers
Automatic sheet feeder
Tractor feed
Daisy wheels
Printer ribbons

Special desk work station
Lockable disk boxes
Paylips
Sound boxes
HARDWARE
CBM 3032 Computer
CBM 3040 Floppy
CBM 3022 Printer

CBM 8032 Computer (new model)
CBM 8050 Floppy (New model)
Qume Springs Daisy Wheel Printer
SERVICES
Installation
Training
Maintenance
After Sales Service

Call into the

DA VINCI COMPUTER SHOP

65 High St., Edgware, Middx.

Tel. 952 0526

Open Mon-Fri. 9-5.30, Sat 9.30-5.00
or send for details



Floppy Discs £2 each + VAT.

Qume sprint 5 £1,595 + VAT.

CBM 8026 Daisywheel Printer inc Keyboard

£995 + VAT.

AFTER NUMEROUS REQUESTS,
HERE IT IS....

THE ZX81 COMPANION

PRICE £7.95 INCL. UK POSTAGE

LINSAC's latest publication includes over forty
ZX81 programs and routines, and sections on
real-time graphics and the monitor. It is designed
as an extension of the Sinclair manual, with all
the quality and depth found in its predecessor,
THE ZX80 COMPANION. Owners of 8K ROM
ZX80's will also find the book an invaluable
asset.

Send cheque for £7.95 to:

LINSAC 68 Barker Road, Linthorpe,
Middlesbrough, Co. Cleveland TS5 5ES

LOW COST

MEMORIES FULL SPEC DEVICES

2114-350ns	£1.75
2114-250ns	£2.75
4116-200ns	£1.80
2716-2516 +5v	£3.50

LOW PROFILE SOCKETS

14pin-10p	16pin-11p
18pin-16p	24pin-30p
40pin-40p	

DISCOUNTS

1-9 nett
10-24 less 5% 25+ less 10%

To Order: Send Cash/Cheque/P.O.'s or
Bankers Draft with order
Add 15% VAT to all orders. P&P add
50p for orders of less than £10

MEMTEC

21a, STATION RD
KNEBWORTH
HERTS Tel (0438) 812137/811525



Pete & Pam Computers

Micro Computer Hardware and Software Specialists in Applefare

We are distributors for: Microsoft, High Technology, Stoneware, Broderbund, California Pacific, United Software, Videx, On-Line Systems, Sirius, Stellation-Two, Daken Corporation, Micro-Pro Sub-Logic, ABT, Computer Station, Versa Computing, Symtec, Micro-Lab, Synergistic, Avant Guard, Lazer Systems, M & R Enterprises, South Coast Enterprises and Street Electronics.

We welcome dealer enquiries. All the products we advertise are available from your local dealer.

RAMCARD £109.95
A 16K Expansion card for your Apple. It will provide additional memory for Visicalc, load integer from a System Master and is fully compatible with Apples Pascal System.

Z-80 SOFTCARD £169.00
A Z-80 microprocessor for Apple. Comes with CP/M operating system and Microsoft Basic 5.

COBOL 80 £299.00
FORTRAN 80 £109.95
BASIC COMPILER £199.00
ASSEMBLY LANGUAGE DEVELOPMENT £79.00

THE MILL 6809 £169.00
A 6809 processor add-on for Apple. Can work in conjunction with 6502. Compatible with FLEX operating system. Assemblers are available.

PASCAL SPEED-UP KIT £79.00
Works in conjunction with the 6809 to greatly increase the speed of execution of Apple Pascal programs.

80 COLUMN BOARDS
Take your pick -
SUP-R-TERMINAL £195.00
VIDEX £185.00

PASCAL JOB CONTROL SYSTEM — From High Technology. £395.00
A fast, sophisticated job control/costing system able to control costs on 400 jobs, providing useful reports and maintaining 50 cost centres with 500 sub cost centres. Worth its weight in gold!

FLIGHT SIMULATOR by Sub-Logic Disk £19.95
So realistic — you might feel a sick! — be warned! Cassette £14.95

DB MASTER £129.95
The Data Base with 100 fields operating on multi-diskette files for large capacity.

INFORMATION MASTER — Data Base £79.00
A dream to use, has advanced facilities such as global change and calculator mode of entering figures. A system that a novice can use with ease.

DATA MASTER £55.00
A utility for use with Information Master. Allows the splitting of a data base system selectivity, change of field types and transfer of print formats.

TRANSIT £29.00
A utility that enables you to link Information Master to many files including those created by Visicalc.

MICRO PRODUCTS £49.95
Editor/Assembler/Disassembler/Debug.

ECHO II £129.00
A speech synthesizer consisting of a card speaker and a diskette with software using 'Linear Predictive Coding' to produce sound. Based on Texas Instruments TMS 5200 — an upgraded version of 'speak and spell' chip.

CCS INTERFACE CARDS — at bargain prices
Centronics Parallel £66.00
Parallel £59.00
Synchronous £79.00
Arithmetic Processor £199.00
Clock/Calendar Card £69.95

MEMORY MANAGEMENT SYSTEM £29.00
A utility that moves DOS onto a 16K expansion card — freeing motherboard Ram space for larger programs.

MUSIC SYSTEM from Mountain £275.00
16 oscillator music synthesizer, in stereo! Program your own waveforms to create any instrument sound. We put you in touch with the UK users group.

EXPANSION CHASSIS £399.00
Long awaited — here at last. More slots for your Apple.

CLEAR PLEXI-GLASS LIDS £14.95
Be vain — show off the inside of your Apple!

Apple Galaxian — Galaxy Wars — Head-On — Galactic Revolution — Galactic Trader — Galactic Empire — Olympic Decathlon — Mystery House — Bridge Partner — Checker King — Gammon Gambler — Roulette — Craps — Apple 21 — Puckman — Global War

All at £13.95

Microsoft Adventure — ABM — Dog Fight — Phantoms Five — Orbitron — Pulsar — Microchess 2.0 — Odyssey — La Land Monopoly — Morloc's Tower — Rescue at Rigel — Space Eggs — Trilogy of Games — The Prisoner

All at £14.95

Computer Conflict — Computer Quarterback — Cartels and Cutthroats — Space Album — Bill Budge 3D Graphics Tutor — Cyber Strike — 3 Mile Island — Adventure 123 — Adventure 456 — Adventure 789 — Hi-Res Soccer — Temples of Apshai — Hellfire Warrior — Zork

All at £20.95

Buy any five games and you can deduct 5% off the total price!

Prices do not include VAT. Please add 15% VAT to your remittance. Postage and packing FREE.



Yes! We do take Visa Cards

Authorised Apple Sales and Service
98 MOYSEY ROAD, LONDON SW16 6SH
Tel: 01-677 2052/7341

PET EPROM PROGRAMMER

MAKE YOUR OWN PET GRAPHICS & SIGN



ONLY £37.50

INCLUDING INSTRUCTION TAPE
2716 EPROMS £5.00 EACH

coming soon
NEW TOOLKIT

PET GRAPHICS
MADE TO ORDER
S.A.E. FOR DETAILS

£20

- * COMPLETELY SELF CONTAINED.
- * PLUGS INTO I-EEE PORT
- * EASY TO FOLLOW INSTRUCTION PROGRAMME.
- * MAKE YOUR OWN TOOLKITS
- PERMANENT COPIES OF MACHINE CODE PROGRAMMES TO SLOT INTO AVAILABLE SPARE ROM SOCKETS

EPROMS ERASED only £1.00

NEW ELECTRONIC SYMBOLS FOR EASY PROGRAMMING OF PCB BOARDS AND CIRCUIT DIAGRAMS ON YOUR PET SCREEN. THE EPROM REPLACES EXISTING CHARACTER GENERATOR ON YOUR PET



PLUS DEMONSTRATION TAPE ONLY £19.50

COMPUTER INTERFACE DESIGNS

4 ALBERT ROAD, MARGATE, KENT CT9 5AN

p&p 50p EXTRA

WIDEBAND

WIDEBAND PRODUCTS
Presents

SPEAKEASY

Speech Synthesiser

Complete with loudspeaker and parallel input, suitable for most computers: eg.

ACORN, PET, APPLE, NORTHSTAR,
PEP11, IBM370.

Clear intelligible male speech is program-med with phonetic codes.

As featured on BBC 4, BBC and ITV television.

RETAIL PRICE ONLY £69 + VAT

Dealer Enquiries Invited.
TEL' CAMBRIDGE (0223) 208017

'CFACC'

"THE BEST ACCOUNTS PROGRAMME ON THE MARKET*" — £900

—MAIN MENU—

- | | |
|--------------------------|----------------------------------|
| 1. ADDRESS PROGRAMME | 16. BANK RECONCILIATION |
| 2. SALES INVOICES | 17. PURCHASE LEDGER |
| 3. PURCHASE INVOICES | 18. SALES LEDGER |
| 4. STOCK CONTROL | 19. END OF MONTH PROCEDURE |
| 5. ORDER CONTROL | 20. VAT STATEMENTS |
| 6. PAYROLL | 21. MANAGEMENT FINANCIAL REPORTS |
| 7. PAYMENTS MADE | 22. PROFIT & LOSS ACCOUNT |
| 8. PAYMENTS RECEIVED | 23. BALANCE SHEET |
| 9. CREDITORS | 24. CASHFLOW FORECASTS |
| 10. DEBTORS | 25. INCOMPLETE RECORDS |
| 11. SUPPLIER STATEMENTS | 26. DISK DIRECTORIES |
| 12. CUSTOMER STATEMENTS | 27. DISK CHANGE |
| 13. AGENTS STATEMENTS | 28. DISK SPACE FREE |
| 14. PRINT CUSTOMER INDEX | 29. PRINT LEDGER CODES |
| 15. PRINT SUPPLIER INDEX | 30. PRINT STOCK LISTS |

—PLEASE ENTER SELECTION NUMBER—

'CFACC' ACCOUNTS PROGRAMME — COPYRIGHT COMPUTERS FOR ALL LTD

1. The Programme resides totally "in care" leaving BOTH DISKS FREE for files and enabling disks to be changed during use.
2. Every Programme issued is "PERSONALISED" with your Company's details. The programme is only available from ourselves or through Dealers as our Agents. We pay them commission and retain all "After Sales Service" ourselves. Our "After Sales Service" is positive, giving you constant access to the Author of "CFACC".
3. You need only enter invoices and other payments in and out and "CFACC" will produce all the DATA for the MENU Programmes (it will ask the user for any other information it needs).
4. All relevant information is stored for CUSTOMERS, SUPPLIERS, EMPLOYEES and Others.
5. Automatic VAT Calculations.
6. Automatic calculations of WAGES and SALARIES.
7. INVOICES can be produced automatically using Customers' names and addresses from file and Stock Items from file — all calculations are automatic.
8. INVOICES are automatically printed on plain paper (CFACC can easily and cheaply be adapted by us to print on your own stationery).
9. STOCK FILE is automatically UPDATED whenever a Purchase or Sales Invoice is entered and the User's attention is drawn to any item which has reached RE-ORDER LEVEL.
10. Customer and Supplier Statements printed on demand showing Current, 1 Month, 2 Months, and 3 Months and over figures. These are automatically updated as payments are entered. The User's attention is automatically drawn to any Customer exceeding his CREDIT LIMIT.
11. Automatically calculates COMMISSION due to Agents and Salesmen.
12. DEBTOR and CREDITOR lists available on demand.
13. PROFIT & LOSS ACCOUNT, BALANCE SHEET and TRIAL BALANCE printouts on demand.
14. MANAGEMENT FINANCIAL REPORTS include:
 - i) GROSS PROFIT RATION
 - ii) RATE OF STOCK TURNOVER
 - iii) NET PROFIT as a PERCENTAGE OF SALES
 - iv) INCOME STATEMENTS.
15. CASHFLOW FORECAST on demand.
16. INCOME & EXPENDITURE is analysed into 80 ledger classifications and the amounts in any one of these can be called at any time.
17. ENVELOPES or ADDRESS labels can be printed from Address Files.
18. Full Random Access to any record in any file — No Limit on Record Lengths.
19. Ledgers are automatically updated after every transaction.
20. All sections of the Programme and files are fully integrated.
21. Some Programmes on the market claim to be easy to use with no need for a manual (BUT TO THE LAYMAN THEY SIMPLY ARE NOT). "CFACC" really is USER ORIENTATED — WE ARE PREPARED TO LET YOU PROVE THIS FOR YOURSELF. MONEY RE-FUNDED IN FULL IF YOU CAN SHOW US A BETTER MICROCOMPUTER ACCOUNTS PROGRAMME WITHIN 7 DAYS OF USE.
22. The PRICE makes "CFACC" the best VALUE FOR MONEY on the Market.
23. Fully tested and debugged.
24. All Equipment is fully tested by us prior to installation — Normal Guarantees on all Equipment Service Contracts available — Finance and Leasing can be arranged.
25. DELIVERY and INSTALLATION FREE within UK.
26. We have examples of other Accounts Programmes on the market which you are welcome to try, and compare them with "CFACC".

64K 'SUPERBRAIN' (350K DISK STORAGE) — DAISYWHEEL PRINTER — "CFACC" ACCOUNTS —

"WORDSTAR" Word
Processing.

** ALL FOR £3,686.00 **

Computers For All Ltd. Stratford on Avon (0789) 840064

24-Hour Service on 021-236 1794 Ext. 224.



FREE SOUND WITH VIDEO GENIE!



CASE FOR OHIO SUPERBOARD
or UK101 ONLY £24
IN PLASTIC OR £37
IN STEEL!

NUMBER PAD FOR ABOVE
ONLY £12

WE CAN NOW OFFER THE INCREDIBLE
VIDEO GENIE FOR ONLY £279 INCLUDING
SOUND! 32K EXPANSION INTERFACE FOR
ONLY £279 AND 40 TRACK DISKS FOR
ONLY £195 SINGLE AND £380 DUAL!



CENTRONICS 737 LETTER
QUALITY PRINTER ONLY
£345



PET-CENTRONICS
FULLY DECODED
INTERFACE
NOW ONLY £49

APPLE - CENTRONICS INTERFACE ONLY
£79



OHIO SUPERBOARD
COMPLETE WITH SOUND,
POWER SUPPLY, MODULATOR
FULLY BUILT & TESTED FOR
BRITISH T.V. STANDARDS
ONLY £159



ALL PRICES INCLUDE POSTAGE & PACKING BUT EXCLUDE V.A.T.
KRAM ELECTRONICS, VICTORIA HOUSE, 17 HIGHCROSS STREET, LEICESTER



TRS 80 and VIDEO GENIE PROGRAMS

DUPLITAPE £9.50

A copy program which can copy any length program or data-file on a machine with 4K of RAM. DUPLITAPE is not a simple copy program but is designed to alter and reposition the tape pulses so that difficult tapes will load easily. It requires two cassette recorders. It will copy most protected tapes and adventures.

CHAIN-LINK £9.50

This program allows long BASIC programs to be split up so that they will run in a small memory size. It allows variables including strings to be passed from one program to another. It has a built in MERGE for BASIC programs and allows two BASIC programs to be kept separate in memory if needed. 16 KLI only.

WIZARDS CASTLE £9.50

A role playing adventure with real maps. The objective is to find the treasures in a 500 room castle. The castle has monsters which have to be fought together with other hazards. Every time the program is run, the castle will be different. Magic spells are also used. For Dwarfs, Hobbits, Elves and Humans. 16K LII only.

ACULAB DATA BASE £9.50

A general purpose data base to run with an Aculab Floppy Tape under Extended BASIC. The use of the PIMS manual by Scelbi Publications is recommended. Functions supported include Help Command, Arithmetic, Searching, Sorting, Listing, Printer output, if required, Printing of 5 line address labels. Commas are allowed in the text lines. As this is intended for present owners of PIMS, the instructions will only cover the new commands fully, other commands being summarised.

AND NOW

NIGHT DRIVER by B DANIELS

A fast 3-D car drive along a road at night. You see the twisting road through your windscreen. Can you control your car and avoid police speed patrol? With sound.
Disc £11.50 Tape 9.50

ALBION SOFTWARE Lammas Rd, Leyton London E.10
01- 539 7071/4

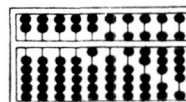
PET' MACHINE LANGUAGE GUIDE



- Contents include sections on:
- Input and output routines.
 - Fixed point, floating point, and Ascii number conversion.
 - Clocks and timers.
 - Built-in arithmetic functions.
 - Programming hints and suggestions.
 - Many sample programs.

If you are interested in or are already into machine language programming on the PET, then this invaluable guide is for you. More than 30 of the PET's built-in routines are fully detailed so that the reader can immediately put them to good use.

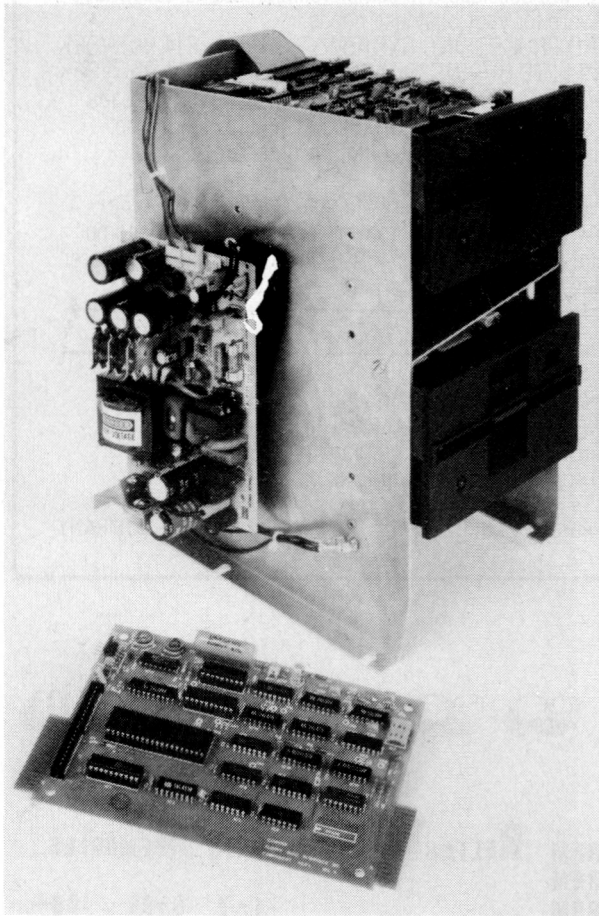
Available for \$7.95 + \$2.00 postage and handling. Payment is in U.S. dollars or charged to your Barclaycard or Eurocard - include card number and expiration date. Quantity discounts are available.



ABACUS SOFTWARE

P. O. Box 7211
Grand Rapids, Michigan 49510

TRS 80 MODEL III DUAL DENSITY DISK DRIVE UPGRADE KITS



Kit comes assembled and tested as illustrated. Full installation instructions given. Kit includes:—

2 x 40 TRACK DUAL DENSITY DRIVES

OR 2 x 80 TRACK DUAL DENSITY DRIVES
DISK CONTROLLER BOARD

240 VOLTS AC SWITCHED MODE POWER SUPPLY

ALL CONNECTORS AND CABLES

PRICES

KIT WITH 2 x 40 TRACK DRIVES **£599**

KIT WITH 2 x 80 TRACK DRIVES **£729**

Call your nearest dealer for more information:

RADIO SHACK LTD.,
188, Broadhurst Gardens,
London NW6
Tel: 01-624-7174

COMPSHOP LTD.,
14, Station Road,
New Barnet, Herts.
Tel: 01-441-2922

COMPSHOP LTD.,
311, Edgware Road,
London W2
Tel: 01-262-0387

LONDON COMPUTER CENTRE, 43, Grafton Way, London W1
Tel: 01-388-5721

N.I.C.,
61, Broad Lane,
London N15
Tel: 01-808-0377

CROYDON COMPUTER CENTRE, 29a, Brigstock Road, Thornton Heath, Surrey
Tel: 01-689-1280

P J EQUIPMENT LTD.,
3, Bridge Street,
Guildford,
Tel: 0483-504801

R.D.S. ELECTRICAL LTD., 157-161, Kingston Road, Portsmouth
Tel: 0705-812478

TANDY HASTINGS LTD., 48, Queens Road, Hastings
Tel: 0424-431849

MICROWARE COMPUTING SERVICES, 57, Queen Charlotte Street, Bristol
Tel: 0272-279560

SEVET TRADING, 14, St. Paul's Street, Bristol
Tel: 0272-697757

PARWEST LTD., 58, Market Place, Chippenham
Tel: 0249-2131

ENSIGN, 13-19, Milford Street, Swindon, Wilts
Tel: 0793-42615

EMPRISE LTD., 58, East Street, Colchester
Tel: 0206-865926

CAMBRIDGE COMPUTER STORE, 1, Emmanuel Street, Cambridge
Tel: 0223-65334

I.C. ELECTRONICS, Flagstones, Stede Quarter, Biddenden, Kent
Tel: 0580-291816

MICRO CHIP SHOP, 190, Lord Street, Fleetwood, Lancs.
Tel: 03917-79511

MICRO CHIP SHOP, 197, Waterloo Road, Blackpool
Tel: 0253-403122

MICRO CHIP SHOP, 93, Friargate, Preston, Lancs.
Tel: 0772-22669

HARDEN MICRO-SYSTEMS, 28-30, Back Lord Street, Blackpool.
Tel: 0253-27590

NORTH WEST COMPUTER CONSULTANTS LTD., 241, Market Street, Hyde, Cheshire
Tel: 061-366-8624

HEWART MICRO-ELECTRONICS, 95, Blakelaw Road, Macclesfield.
Tel: 0625-22030

KARADAWN LTD., 2, Forrest Way, Great Sankey, Warrington.
Tel: 0925-572668

PHOTO-ELECTRICS, 459, London Road, Sheffield.
Tel: 0742-53865

BRIARWOOD COMPUTER SERVICES Briarwood House, Preston Street, Bradford.
Tel: 0274-306018

GNOMIC LTD., 46, Middle Street, Blackhall, Hartlepool
Tel: 0783-863871

BRIERS COMPUTER SERVICES, 1, King Edward Square, Middlesbrough, Cleveland
Tel: 0642-242017

3 LINE COMPUTING, 36, Clough Road, Hull.
Tel: 0482-445496

H.C. COMPUTER SALES LTD., 182 Earlsway, Team Valley Trading Estate, Gateshead
Tel: 0632-874811

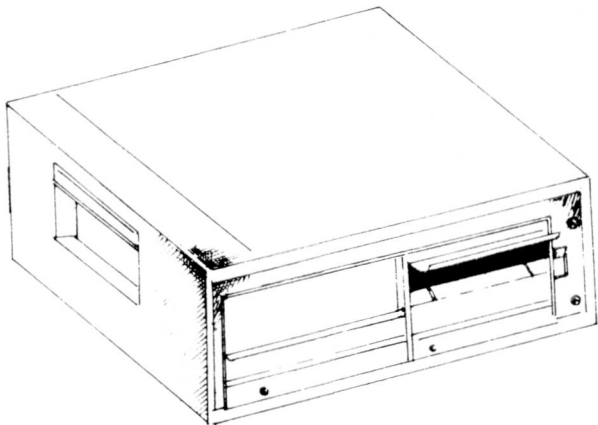
EWL COMPUTERS LTD., 8, Royal Crescent, Glasgow
Tel: 041-332-7642

CUMANA LTD 35 Walnut Tree Close, Guildford, Surrey, GU1 4UN.
Telephone: (0483) 503121.

*Please add VAT to all prices.
Delivery at cost will be advised
at time of order.*

TEMPLEMAN SOFTWARE LIMITED

25-26 Greenhill Street, Stratford Upon Avon
Warwickshire CV37 8LR
Telephone: Stratford Upon Avon (0789) 66237



8" DOUBLE SIDED, SINGLE
DENSITY FLOPPY DISC DRIVE.

*THEY HOLD FIVE TIMES AS
MUCH INFORMATION AS 5"
DRIVES, I.E. ONE MILLION
CHARACTERS.

*INCLUDES S.V.A. CARD

*PASCAL IS AVAILABLE.

*ITT SILVER OR APPLE CREAM
CASING.

*R.R.P. £1550 (exc. VAT).

*DEALER ENQUIRIES WELCOME.

SOFTWARE IS OUR MIDDLE
NAME



THE LONDON SORCERER CENTRE

EMG MICROCOMPUTERS LTD.
30 HEATHFIELD ROAD, CROYDON, SURREY CRO 1EU.
TEL: 01-688 0088

We are specialists in complete installations, tailor made
software for your business needs.

WORD PROCESSING SYSTEM £14.99/WEEK
COMPLETE BUSINESS SYSTEM £24.99/WEEK

Software includes customer and invoice system, leads
and sales system, VAT outputs and debtors, insurance
agents system, car sales program, order processing
program.

We provide any printer to fit your Sorcerer e.g. Qume,
Starwriter, Spinwriter, Centronics 737 and NEW Adcomp
printer plotter matches '848 Graphics capability of Sorcerer
to give complete graphics.

★ SPECIAL OFFER ★

Sorcerer 48K for only £595

- ★ Special Educational Discount
- ★ Demonstrations and Quotes given
- ★ Free Software and Hardware catalogue
- ★ 6 copies of Source magazine £6

ALL PRICES EXCLUDE VAT

AN EMG COMPANY



R.E.M.

010 REM RELIABLE ELECTRONIC MEMORIES.

020 REM				1-7	8-99	100+
030 REM						
040 REM	4116	200ns		1.60	1.50	1.40
050 REM	2114L	300ns		1.70	1.60	1.50
060 REM	2114L	200ns		2.00	1.90	1.75
070 REM	2708			3.10	2.90	2.80
080 REM	2716			4.50	4.40	4.30
090 REM						
100 REM						
110 REM						
120 REM	These prices are bottom line costs					
130 REM	No extra for V.A.T. or P&P.					
140 REM						
150 REM	One year guarantee.					
160 REM						
170 REM	Minimum order of £5.00 please					
180 REM	Send cheque postal order cash to					
190 REM						

200 REM	RELIABLE ELECTRONIC MEMORIES,					
210 REM	13 Allan Court					
220 REM	East Kilbride					
230 REM	Glasgow					
240 REM	875 8BU					

R.E.M.



“...in conclusion, the best all-round business system that I have seen.”

Mike Dennis

Price : **£2699** plus V.A.T.



FURTHER DETAILS FROM

MIKE DENNIS ASSOCIATES

COMPUTER SYSTEMS

91 High Street, Evesham, Worcestershire WR11 4DT Telephone: Evesham (0386) 48240

VIGIL

INTERACTIVE GRAPHICS/GAME LANGUAGE FOR THE PET/CBM



VIGIL is an exciting new interactive language for your PET/CBM micro. VIGIL - Video Interactive Game Interpretive Language - is an easy to learn graphics and game language that lets you quickly create interactive applications.

- More than 60 powerful commands permit you to easily manipulate graphics figures on the screen
- Double density graphics give you 80 X 50 plot positions on your 40 column PET/CBM
- Large number display capability, access to two event timers and tone generation (if you have ext. speaker)
- Load and save your VIGIL programs to cassette
- Nine interactive programs demonstrate the power of VIGIL - Breakout, SpaceWar, AntiAircraft, U.F.O., SpaceBattle, Concentration, Maze, Kaleidoscope & Fortune
- Comprehensive user's manual with complete listings of enclosed programs

VIGIL comes on cassette, ready to run on any 40 column PET/CBM micro with at least 8K of memory. Specify ROM-set when ordering. 6502 listing of the VIGIL Interpreter available separately.

	US & Canada	Foreign
VIGIL for PET/CBM on CASSETTE (w/nine programs)	\$35	\$40
VIGIL User's Manual (refundable with software)	\$10	\$12
VIGIL Interpreter listing (6502 Assembly language)	\$25	\$30
PET MACHINE LANGUAGE GUIDE	\$8	\$10



ABACUS SOFTWARE
P. O. Box 7211
Grand Rapids, Michigan 49510

VISA



Prices include postage. Michigan residents include 4% sales tax. Orders must be prepaid or via bankcard (Mastercard, VISA, Eurocard, Access, etc.) Include card number and expiration date.

(C) 1981 by Roy Wainwright

PET & APPLE II USERS

TINY PASCAL

Plus +
GRAPHICS



The TINY Pascal System turns your APPLE II or PET micro into a 16-bit P-machine. You too can learn the language that is slated to become the successor to BASIC. TINY Pascal offers the following:

- LINE EDITOR to create, modify and maintain source
- COMPILER to produce P-code, the assembly language of the P-machine
- INTERPRETER to execute the compiled P-code (has TRACE)
- Structured programmed constructs: CASE-OF-ELSE, WHILE-DO, IF-THEN-ELSE, REPEAT-UNTIL, FOR-TO/DOWNTO-DO, BEGIN-END, MEM, CONST, VAR ARRAY

Our new TINY Pascal PLUS+ provides graphics and other builtin functions: GRAPHICS, PLOT, POINT, TEXT, INKEY, ABS AND SQR. The PET version supports double density plotting on 40 column screen giving 80 x 50 plot positions. The APPLE II version supports LORES and for ROM APPLESOFT owners the HIRES graphics plus other features with: COLOR, HGRAPHICS, HCOLOR, HPLOT, PDL and TONE. For those who do not require graphics capabilities, you may still order our original Tiny Pascal package.

PET BASIC 4.0 version also available

TINY Pascal Plus - GRAPHICS VERSION-Includes manual	
PET 32K NEW Roms cassette	\$85
PET 32K NEW Roms diskette	\$60
APPLE II w/ROM Applesoft only w/DOS	\$60

TINY Pascal NON-GRAPHICS VERSIONS-Includes manual	
PET 16K/32K NEW Roms cassette	\$50
PET 16K/32K NEW Roms diskette	\$45
APPLE II w/ROM Applesoft 32K w/DOS	\$45
APPLE II w/ROM Applesoft 48K w/DOS	\$45

USER's Manual (refundable with software order)	\$12
6502 Assembly Listing of INTERPRETER-graphics	\$30
non-graphics	\$25

Includes Airmail Postage to Europe. Orders may be prepaid or by bankcard (include card number and expiration date). Eurocard, Access, Barclaycard, etc.



ABACUS SOFTWARE
P. O. Box 7211
Grand Rapids, Michigan 49510

TECPACS

The reliable technical programs for desktop computers

Professional designers, engineers and scientists must carry out a variety of routine calculations in the course of their work. Today, these routine calculations can be automated to save time and cut costs. But for real economic savings, reliable technical software is necessary.

TECPACS are high-quality, technical software packages, written and tested by professionals for professionals. They can be used in your office, no large centralised computing facilities

are needed, and computing experience is unnecessary. With TECPACS, designers and engineers can explore the design alternatives with ease and confidence. Modifications can be made as the program runs, saving further time.

TECPACS are produced by the Technical Software Centre, set up by BHRA Fluid Engineering and NRDC.

TECPACS offer such features as

- ☐ Built-in high technical standard
- ☐ Easy to use, friendly style

- ☐ Data checking facilities
- ☐ Trend facilities
- ☐ Choice of units
- ☐ High-quality presentation of results

TECPACS add another professional to your team. In your office, or in the design office, just switch on, select your TECPAC program disk, and in minutes you have the answers you need.

For further details, and up-to-the-minute lists of TECPACS available contact the:
Technical Software Centre
 BHRA Fluid Engineering
 Cranfield, Bedford MK43 0AJ
 England
 or telephone Dr Eugene Sweeney on
 0234 750 102

Technical Software Centre
tec pac



Datron of Sheffield for Cromemco — the ultimate name in micros

- * **Datron import**
- * **Datron supply**
- * **Datron stock**

DIRECT FROM
 CROMEMCO

AND SUPPORT
 NATIONALLY

CROMEMCO SYSTEMS,
 CARDS & SOFTWARE



Datron Prices				
Unit	RAM	ROM	Disc	
System Zero/D	64K	4K	2 x 390K	£ 2,756
System 2	64K	4K	2 x 390K	£ 2,842
System 3	64K	4K	2 x 1.2M	£ 4,556
Hard Disc Z2-H	64K	4K	10M + 2 x 390K	£ 6,045
Z2H Colour Graphics	64K	4K	10M + 2 x 390K	£ 8,775†

Prices include Interfaces for VDU, dot matrix and letter quality printers, documentation and systems familiarization.

† also includes 13" RGB Monitor and 2 x 48K graphic memory cards.

DEALER ENQUIRIES WELCOME



Wide range of languages,
 16K and 32K Basic,
 Cobol, Rational Fortran
 and Fortran IV, Lisp,
 RPG etc. Operating systems
 — Cromemco CDOS, CP/M
 Compatible or Cromix
 for Multi-User

Write or 'phone for free advice
 and catalogue or call in for a
 demonstration.

DEMONSTRATIONS 9am-5pm
 MONDAY-SATURDAY

DATRON MICRO CENTRE
 DATRON INTERFORM LTD

2 Abbeydale Road, Sheffield S7 1FD.
 Telephone 0742-585490 / 585400.
 Telex 547151.

BULK EPROM PROGRAMMING

P400 PRODUCTION EPROM PROGRAMMER

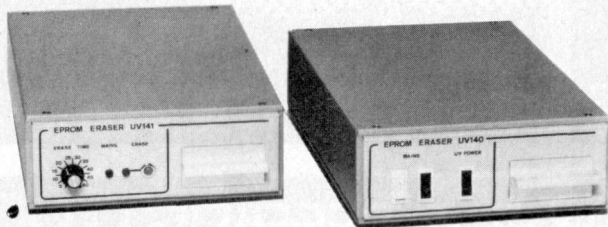
2 YEAR WARRANTY



This unit provides simple, reliable programming of up to 8 EPROMS simultaneously it has been designed for ease of operator use — a single 'program' key starts the self check — blank check — program — verify sequence. Independent blank check & verify controls are provided along with mode, pass/fail indicators for each copy socket and a sounder to signal a correct key command & the end of a programming run. Any of the 2704/2708/2716 (3 rail) & 2508/2758/2516/2716/2532/2732 (single rail) EPROMS may be selected without hardware or personality card changes.
PRICE £545 + VAT. Postage paid.

BULK EPROM ERASING

EX-STOCK



MODEL UV141 EPROM ERASER

- 14 EPROM capacity
- Fast erase time
- Built-in 5-50 minute timer
- Convenient slide-tray loading devices
- Safety interlocked to prevent eye and skin damage
- Rugged construction
- MINS & ERASE indicators
- Price £78 + VAT postage paid.

MODEL UV140 EPROM ERASER

Similar to Model UV141 but without timer. Price £61.50 + VAT post paid.

BULK EPROMS

EX-STOCK

	1-9	10-24	25-49	50-99	100 up
2716 (450ns) (single rail)	£6.00	5.50	£5.00	£4.50	£3.90
2708 (450ns)	£3.90	£3.50	£3.10	£2.90	—

Postage and Packing is included in all prices. ADD VAT at 15%. All our EPROMS are manufactured by leading companies and are fully guaranteed, branded and to full specification.

WRITE OR TELEPHONE FOR FURTHER DETAILS OR SEND OFFICIAL COMPANY ORDERS/CHEQUES TO:

PLEASE NOTE NEW ADDRESS & TELEPHONE NUMBER

GP INDUSTRIAL ELECTRONICS LTD

Unit 6, Burke Road, Totnes Industrial Estate, Totnes, Devon
Telephone: Totnes (0803) 863360 sales, 863380 technical
Telex No. AS 42596

DISTRIBUTORS REQUIRED - EXPORT ENQUIRIES WELCOME

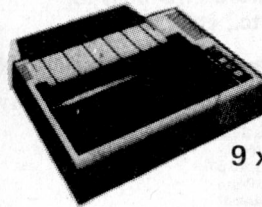
INTELLIGENT ARTEFACTS LTD

ALL PRODUCTS
GUARANTEED FOR ONE YEAR
Repairs on any equipment carried
out by trained engineers

- 4016 — 16K — £449 + VAT
- 4032 — 32K — £559 + VAT
- 4040 — Disk unit — £565 + VAT
- 8032 — 32K — £759 + VAT
- 8050 — "1MB" Disk £759 + VAT



LATEST 4000 and 5000 series PETS with large Keyboards and 8K basic in ROM. Popular easy to use Microcomputer.



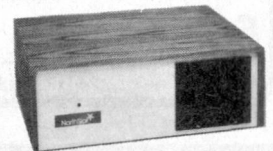
MX80T £275 + VAT

MX80F/T £349 + VAT

Epson printers, quiet, bi-directional logic seeking. 9 x 9 matrix £ sign Pet and Apple interface lower case descenders

SUPERBRAIN withdrawn due to quality problems

- 32K Dual Drive DD — £1549 + VAT
- 32K Dual Drive QD — £1649 + VAT
- 64K Dual Drive QD — £1999 + VAT



North Star Horizon an established reliable basis for any microsystem complete with DOS 5.2 and Basic language



Speech output for the **WIDEBAND** Speakeasy. A low cost speech unit suitable for any small microcomputer. Ideal for anyone interested in developing speech output. Has infinite vocabulary — £69 + VAT.

EXTRAS

- Toolkits from £24 + VAT
- Cassettes £45 + VAT
- Forth for Pet £45 + VAT
- Watanabe Plotter only £699 + VAT
- Pet Disk Debug — £18 + VAT Popular aid to disk programming and removal of disk corruptions.

Please send me

Name

Address

I enclose cheque/P.O. for £.....
(add £15 for P&P for each item of hardware).

INTELLIGENT ARTEFACTS LTD.

Cambridge Road, Orwell, ROYSTON, Herts.
Cambridge (0223) 207689



FOR PET, SUPERBOARD, UK101, NASCOM.

- * COMPLEX EFFECTS AND MUSIC
- * USES INCREDIBLE AY-3-8910
- * COMPLETELY BUILT, SIMPLY PLUGS IN **£43**
- * BASIC OR MACHINE CODE
- * BUILT IN AMP & SPEAKER + STEREO
- * INCLUDES 2 8 BIT I/O PORTS
- * COMATIBLE WITH OTHER EXPANSIONS
- * FREE DEMO PROGRAM + INSTRUCTIONS

+ VAT
EX STOCK

Send for free information leaflets.

NB: 8T28 buffers (Superboard/UK101) next 6502 @ £3.00 per pair if required

**SOON
AVAILABLE!!**

PHONE, WRITE FOR DETAILS.

Peripheral board 24 I/O lines for relay driving etc., etc.

EPROM Programmer £122 + VAT CD3P FLOPPY DISC £285 + VAT
610 EXPANSION £159 + VAT BASE 2 800Mst PRINTER £309 + VAT

Microcases £26, 2114L 300ns RAM 8 for £22, 4116 300ns 8 for £22.50, 5V 3A power supply for Superboard £15, Vision Modulator high quality £4.50, Sound modulator to match £3.75, 40 pin ribbon cable 40pin DIP 40pin PCB suit Breadboard £4.50, Prototype Breadboard for Superboard UK101 comprehensive labeled bus £5.50, Bus extender to take 610 & peripherals £4.95, Header plugs, 40pin £2.50, 40pin sockets £0.40, 8T28 buffers £1.50 ea, AY 3 8910 sound chip £8.25, Joystick mechanisms £9.95, Blank DATA cassettes £5.25 for 10, Black discs 5 1/4" £3.25.

Trade enquiries welcome.

PLEASE ADD VAT TO THE ABOVE PRICES

Easicomp

57 PARANA COURT, SPROWSTON,
NORWICH NR7 8BH
0603 416352

24 HR ANSWERING SERVICE

MALVERN MICRO SYSTEMS

TEL. 06845 68500

COMPUTERS:

NEW
NEW

Adler Alphatronic
Gemini G801
Intertec Superbrain

Most makes supplied including
Commodore and S100 Systems.

PRINTERS:

Adler DRH80
Microline 80/82
Epson MX70/MX80
Seikosha GP80

Microtrend Professional Software
CP/M Software including
MBasic-80, CBasic, Wordstar
Osbourne A/P, A/R and G/L
Fig-Forth

**WYCHE CUTTING, UPPER COL WALL,
MALVERN, WORCESTERSHIRE, WR13 6PL**

INDEPENDENT COMPUTER ENGINEERING LTD

CROMEMCO Systems & Software

CP/M 2.2 for Cromemco - £95

MP/M 1.1 for Cromemco - £350

CROMEMCO SYSTEM ZERO - £575

S100 Peripherals:

Dump your Hard Disk to 'Reel' Tape in 10 minutes
- 1/2" 9-track 1600 BPI IBM/ANSI compatible tape
drive + controller + software £2500.

Hard Disk Systems - from £2500

Cartridge Disk - from £3950

California Computer Systems

S100 Boards and Systems

64K Dynamic RAM (Bank Select) £350

All prices exclude VAT

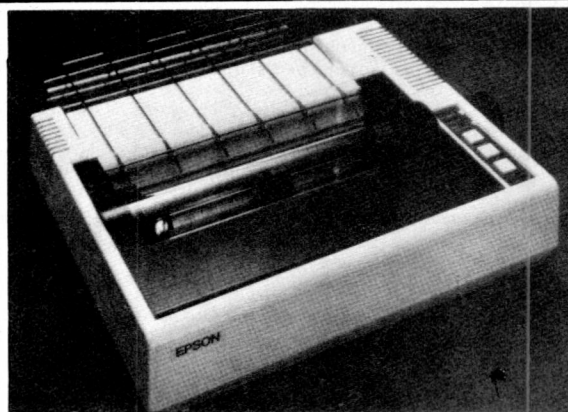
Software packages/Hardware maintenance/Hardware
configuration and design

Further details, please contact:

ICE Independent Computer Engineering,
16/18 Littleton Road, Ashford, Middlesex TW15 1UQ.

Telephone: Ashford (STD 07842) 47171

Telex: 8952042 (DPCUST G)



EPSON MX80 SERIES DOT MATRIX PRINTERS

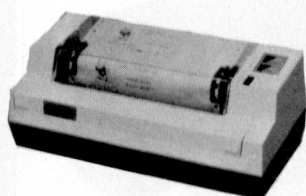
- * 9x9 matrix (true descenders lower case)
- * 80cps bidirectional printing, with 1 logical seeking print head
- * 96 ASCII character set, plus 64 graphics incorporating 4 switch selectable European language options
- * Programmable forms handling
- * 12 different print modes, up to 132 characters per line
- * Operator controls & indicators, self test
- * Options - high resolution graphics, dual friction/tractor feed unit
- * £395 with standard parallel interface (interface options = RS232, Pet, TRS80, MZ80, Apple)

**COMPUTER SOLUTIONS TO BUSINESS PROBLEMS - SOFTWARE PACKAGES/ HARDWARE
MAINTENANCE/HARDWARE CONFIGURATION & DESIGN**

PRINTERS

SEIKOSHA GP-80

The Smallest 80 Column Dot Matrix Printer.

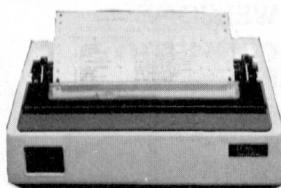


Unique printer principle. 80 col lines. 30 cps. 12 cpl. Plain paper. Tractor drive weight 2.5 kg. Footprint 12.6 sq. ins. Bit addressable graphics. Parallel interface standard. RS 232 Apple Pet TRS 80 options

£199

OKI MICROLINE 80 & 82

Compact 80 Column Printer.



80 cps. Uni direction (ML82 bi-direction). Parallel interface. Serial interface option. (ML 82 standard). Pin and friction feed. Tractor option. Condensed and expanded characters. 80, 40, 66 and 132 cpl.

ML 80 £299

ML 82 £449

EPSON MX SERIES

Low Noise, High Price-Performance Printer.



Five models. 80 cps. Bi-directional. Parallel interface. RS232 Pet Apple TRS 80 Video Genie Sharp options. Letter quality. Lower case descenders. Condensed enlarged and bold characters. Models provide tractor roll and sheet feed - bit image graphics - up to 15 ins paper.

MX-80 £359

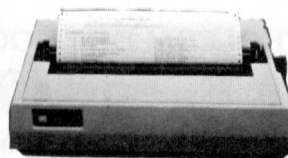
MX-80 F/T-1 £399

MX-80 Type II £425

MX-82 £449 MX-100 £575

OKI MICROLINE 83

Medium Speed 15" Printer.

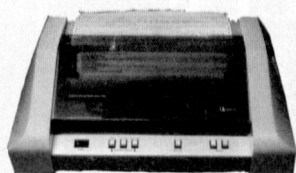


120 cps. Bi-direction. Pin and friction feed. Tractor option. 132 cpl at 10 cpl. 4 character sizes. Graphic characters. Parallel and serial interface. Fast serial interface option.

£799

ANADEx DP-9000 RANGE

High Quality Fast, Versatile Printer.



Four models. Up to 15 inch paper width. Lower case descenders. 160-220 cps bi-directional printing. RS232 current loop & parallel interface. X on X off. Optional 2K buffer. Multiple print densities. Fast print off high-density bit image graphics.

DP-9000 £795

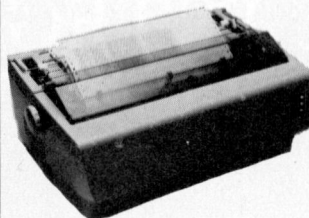
DP-9001 £895

DP-9500 £895

DP-9501 £995

TEC STARWRITER

Best-Buy Daisy Wheel Printer.



Bi-direction. 25 cps. Low cost supplies. Standard Daisy Wheel. Carbon and fabric ribbons. Parallel or RS232 interface. Sheet feeder options.

Parallel Interface £1020

Serial Interface £1067

LEAR SIEGLER 310

Professional Dot Matrix Printer.



High throughput. 180 cps. Bi-direction. Fast head travel. Space skip over. Lower case descenders. Enlarged and bold fonts. Parallel RS232 and current loop interfaces. X on X off. Condensed character option. Sound reducing option.

£1210

FROM

RIVA

RIVA TERMINALS LTD.

Glendale Park, Fernbank Road, Ascot, Berkshire SL5 8JB

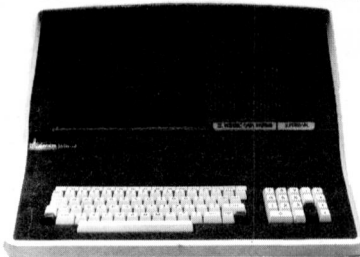
Tel: Winkfield Row (03447) 5193 Telex: 847530

Northern Office: Tel: Wetherby (0937) 61885

- Authorised distributor
- Rapid delivery
- Dealer educational & quantity discounts
- Prices exclude VAT

Try Hunting in the North East

SUPERBRAIN



Full Accounts/Payroll System
including Superbrain SD
and Printer from only £3650

Word Processing System
from only £3125

DISTRIBUTORS
FOR SUPERBRAIN
DEALER ENQUIRIES
WELCOME

COMPETITIVE
PRICES

FULL RANGE OF
PRINTERS -
ANADIX
NEC SPINWRITER
OLYMPIA SCRIPTA
RICOH RP1600

All Prices exclude VAT/Delivery

Other Packages available include
Hotel Billing, Job Costing,
Product Estimating etc.



Established 1874



DEALER FOR MICROS
AND CALCULATORS

MZ-80K PERSONAL
COMPUTER 48K
ONLY £500

Language Translator: £7
French, German, Spanish,
Japanese
Modules £17 each

Talking Time Clock £36



All Prices exclude VAT/Delivery

PC 1211 Pocket Computer only £95

BULK & WHOLESALE DISCOUNTS NORTH EAST SERVICE & SUPPORT

Hunting Business Systems [Hunting Computer Services Limited]

3 Brus House Mitchell Avenue Thornaby Town Centre Cleveland Tel:(0642)64709

BASIC INTEGER COMPILER FOR COMMODORE SYSTEMS

- 50-150 times speed of Commodore Basic.
- Any length variable names.
- Single dimension string and integer arrays.
- Full Integer arithmetic & logical (1 byte variables) for extra speed.
- Code & Data can be set to reside anywhere in memory.
- Many facilities for interface with Commodore Basic programmes.
- New commands can be added to Commodore Basic automatically using WEDGE statement.
- Several extra low-level commands for precision I/O programming, eg DELAY, SETBIT, MOVE, etc.
- Automatic insertion of code into interrupt routine.
- Variables can be individually set to reside at any location allowing direct access to page zero I/O ports, etc.
- Full logical file handling.
- Compiling speed of 3 lines per minute.

Suite includes resident compiler, disk compiler, editor, loader and debugger. Editing environment and language similar to Commodore Basic. Produces ready-to-run 6502 Machine Code.

Detailed Manual £15.00 inc VAT Compiler: 3000 series £150.00 inc. VAT
8000 series £150.00 inc. VAT

Oxford Computer Systems

5 Oxford Street Woodstock Oxford OX7 1TQ Telephone: Woodstock (0993) 812838

CALL IN AND BUY A BETTER BUSINESS AT CREAM

ONE OF THE UK'S TOP BUSINESS SYSTEM DEALERS FOR BOTH THE POWERFUL APPLE II COMPUTER AND THE FULL COMMODORE PET RANGE.

PROFESSIONAL DEMONSTRATIONS AND ADVICE

WIDE RANGE OF RELIABLE & POWERFUL HARDWARE TO CHOOSE FROM

COMPREHENSIVE CHOICE OF FLEXIBLE SOLID SOFTWARE FOR MOST BUSINESS APPLICATIONS, i.e. WORD PROCESSING, PAYROLL, STOCK CONTROL, RECORD KEEPING, INVOICING, AND FULL ACCOUNTING PROCEDURES.

OUR OWN EXPERIENCED SOFTWARE HOUSE TO HANDLE PROMPTLY & PROFESSIONALLY ANY BESPOKE SOFTWARE OR TAILORING NEEDS TO PROGRAMS.

FAST DELIVERY (MOST ITEMS ARE EX-STOCK)

FULL ENGINEERING SUPPORT.

FULL STOCK OF BOOKS, DISCS, TAPES, & OTHER ACCESSORIES FOR THE COMPUTER USER.

CALL US TO DISCUSS YOUR PARTICULAR APPLICATION

BUY FROM CREAM – IT MAKES GOOD BUSINESS SENSE.

CREAM COMPUTER SHOP

380 STATION ROAD, HARROW, MIDDLESEX HA1 2DE. Tel. 01-863 0833
(3 MINS FROM HARROW-ON-THE-HILL TUBE STN)

OPEN TUESDAY – SATURDAY 10AM – 6PM.

ACCESS AND BARCLAY CARD WELCOMED.

High Resolution Professional



From Telefusion

- 750 line resolution
- 10 MHz frequency response
- Looping video input
- UHF input connectors. 75 ohm.
- Compact construction suitable for rack mounting
- Suitable for apple nascom etc.

Complete price to include packing, delivery and VAT

£96.60

Please make cheques, P.O., etc. payable to Telefusion Ltd.

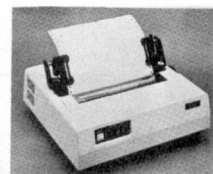
11" 14" 17" 23" monitors also available. Plus rack kits and colour monitors for graphics. Details on request. Trade enquiries welcome.



TELEFUSION

Telefusion Limited, Engineering Division,
Unit 11, Barr's Fold Close, Wingates Industrial Estate, Westthoughton, Bolton BL5 3XH.
Telephone: 0204 66393.

Micro General



MATRIX PRINTERS – FROM £285

Please contact us to discuss which of our range of quality Matrix Printers will best suit your needs and budget. Printer prices include FREE DELIVERY to U.K. Mainland plus 90 days parts and labour warranty.

MICROLINE PRINTERS

MICROLINE PRINTERS

MICROLINE 80 – 80 cps uni-directional printing £285 plus VAT
– Parallel Centronics Interface
– Serial interface & Tractor Feed Options

MICROLINE 82 & 83

- Head life of 200,000,000 characters
- Bi-directional printing with short line seeking
- Centronics Parallel and RS 232 Serial Interface
- 4 Character sizes, ASCII and block graphics
- Programmable VFU and Self Test.
- Optional High Speed Serial Buffers

MICROLINE 82 80 cps Pin & Friction Feed £390 plus VAT

MICROLINE 83 120 cps Tractor & Friction Feed. Takes 4 part 16" paper. £785 plus VAT

EPSON MATRIX PRINTER

- MX-80 SERIES – 80 cps bi-directional printing
– Centronics Parallel Interface
– 4 Character sizes with true decenders on lower case
– Emphasised and Double Emphasised printing
– Horizontal and Vertical Tab Control.

MX-80T Tractor Feed	£345 + VAT	MX-80F/T Friction & Tractor Feed	£395 + VAT	MX-82 High Res. Graphics	£410 + VAT
Optional Interface Boards for Epson to suit APPLE, PET, TRS-80 Sharp, RS232					

APPLE & ITT SALES AND SERVICE
Extra 32K RAM supplied with every complete system purchased

PRINTER PAPER SPECIAL £17
11 x 9 1/2 Plain with perf. 2,000 sheets FREE DELIVERY + VAT

Educational discounts available on request. Remittance plus VAT please to:-

MICRO GENERAL, 6 The Birchwoods, Tilehurst, Reading, Berks RG3 5UH.
Tel: 0734 25226.



MB MICRO BUSINESS CENTRE LTD.

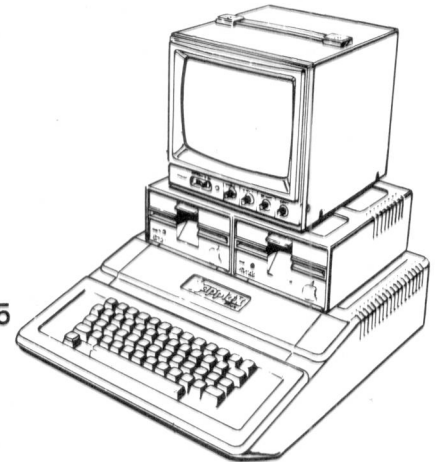
1st FLOOR, LEWIS HOUSE, LINTHOUSE LANE, WEDNESFIELD, WOLVERHAMPTON.

Tel (0902) 725687

NEW LOW LOW PRICES

On Apple hardware & software examples from our extensive range include:

- * Visicalc ~~£125~~ our price £90
- * Pascal Lang System ~~£299~~ our price £249
- * Z80 Softcard ~~£225~~ our price £175
- * New! double sided 3.2/3.3 DOS utility pack £35
- * New! 8" double sided/double density 2.0 megabyte twin disk drive unit £1950.00
- * 5 1/4 disks - box OF10 - 1st quality £22.95 including case
- * Utilise both sides of your discs - gadget & simple instructions £9.95
- * Complete business system inc. Visicalc + Printer £1749.00 or lease from £8.75 per week.



* FINEST QUALITY BUSINESS SOFTWARE *

Word processing - payroll - sales, purchase, nominal ledgers - stock control - specialist programs - extensive games.

- * SPECIAL OFFER - 4 great games on disk for £15.00

Send for our comprehensive catalogue.

Looking for a daisywheel printer???

The Olympia ESW 100 R.O. available at only £799.95

PHONE US FOR
LATEST PRICES

Access/Barclaycard: terms - please add 15% VAT on all prices.
Leasing: mail order: add 75pp orders under £20: over £20 post free.

MAGTRONICS LTD.

MAGTRONICS LTD.
3 GOLDHURST TERRACE
LONDON NW6 3HX
PHONE 01-624 9847

ELECTRONIC COMPONENTS & COMPUTER SUPPLIES

DISKETTES

UNCONDITIONAL GUARANTEE

5.25"	MINI-DISKETTES	SINGLE SIDED
	1 SECTOR	PER 10 £16.50
	(SOFT) PET, TRS80, ETC.	
5.25"	MINI-DISKETTE	SINGLE SIDED
	10 SECTOR	PER 10 £16.50
5.25"	MINI-DISKETTE	SINGLE SIDED
	16 SECTOR	PER 10 £16.50
5.25"	MINI-DISKETTE	DOUBLE SIDED
	1 SECTOR	PER 10 £24.00
8"	SINGLE SIDED	SINGLE DENSITY
	26 SECTOR	PER 10 £18.00
8"	SINGLE SIDED	DOUBLE DENSITY
	26 SECTOR	PER 10 £24.00
8"	DOUBLE SIDED	SINGLE DENSITY
	26 SECTOR	PER 10 £30.00
8"	DOUBLE SIDED	DOUBLE DENSITY
	26 SECTOR	PER 10 £30.00

E. PROMS	
1702A	500p
2708	350p
2716 (+5v)	450p
2732	1200p
2532	1200p

CPU's	
6502	750p
6800	650p
6802	1100p
8080A	450p
8085A	1100p

MEMORIES	
2102-2L	120p
2114-2L	400p
2114-4L	250p
4116-2L	250p
6810	300p

SOCKETS L.P.	
8 PIN	9p
14 PIN	10p
16 PIN	11p
24 PIN	22p
28 PIN	30p

INTERFACE	
MC1488	80p
MC1489	80p
75451	75p
75452	75p
8T28	250p

ROMS	
74S188	275p
74S189	275p
74S470	650p
74S471	650p
74S472	900p

**C.MOS
SUPPORT DEVICES
TRANSISTORS
DIODES
ALL STOCKED
PHONE
FOR QUOTATION**

**DISK ORDERS ADD 90p AND COMPONENTS ADD 50p P&P.
ADD 15% VAT TO TOTAL.
MANY OTHER TYPES OF HARD & SOFT SECTOR DISKETTES
AVAILABLE. PHONE FOR QUOTATION.
MAGNETIC CARDS, DATA CARTRIDGES, DIGITAL
CASSETTES ARE ALSO STOCKED.
OFFICIAL ORDERS FROM SCHOOLS, COLLEGES,
UNIVERSITIES AND GOVT. BODIES ACCEPTED.**

74LS00	14p	74LS26	22p	74LS76	36p	74LS125	50p	74LS163	1.00p	74LS221	1.20p	74LS279	65p	74LS375	1.20p
74LS01	14p	74LS27	22p	74LS78	45p	74LS126	50p	74LS164	90p	74LS240	1.75p	74LS280	1.75p	74LS377	1.60p
74LS02	15p	74LS28	22p	74LS83A	70p	74LS132	60p	74LS165	1.00p	74LS241	1.75p	74LS283	90p	74LS379	1.30p
74LS03	15p	74LS30	20p	74LS85	80p	74LS133	40p	74LS166	1.70p	74LS242	1.75p	74LS290	95p	74LS379	1.80p
74LS04	16p	74LS32	26p	74LS86	40p	74LS136	50p	74LS168	1.70p	74LS243	1.75p	74LS293	95p	74LS381	3.80p
74LS05	22p	74LS33	28p	74LS90	40p	74LS138	65p	74LS169	1.70p	74LS244	1.50p	74LS295	1.45p	74LS386	80p
74LS06	22p	74LS37	28p	74LS91	99p	74LS139	70p	74LS170	1.85p	74LS245	2.50p	74LS298	1.45p	74LS390	1.20p
74LS08	20p	74LS38	28p	74LS92	72p	74LS145	110p	74LS173	1.10p	74LS247	1.40p	74LS324	1.85p	74LS393	1.20p
74LS09	22p	74LS40	22p	74LS93	60p	74LS148	1.70p	74LS174	1.00p	74LS248	1.80p	74LS325	3.00p	74LS395	2.00p
74LS10	18p	74LS42	65p	74LS95	100p	74LS151	80p	74LS175	1.00p	74LS249	1.40p	74LS326	3.00p	74LS396	2.00p
74LS11	22p	74LS47	75p	74LS96	110p	74LS153	80p	74LS181	280p	74LS251	1.30p	74LS327	3.00p	74LS398	2.75p
74LS12	25p	74LS48	85p	74LS107	45p	74LS154	1.60p	74LS190	1.00p	74LS253	90p	74LS352	1.80p	74LS399	2.00p
74LS13	40p	74LS49	100p	74LS109	35p	74LS155	65p	74LS191	1.00p	74LS257	90p	74LS353	1.80p	74LS424	4.50p
74LS14	50p	74LS54	25p	74LS112	35p	74LS156	75p	74LS192	1.00p	74LS258	1.20p	74LS365	50p	74LS445	1.85p
74LS15	25p	74LS55	25p	74LS113	45p	74LS157	60p	74LS193	1.00p	74LS259	1.60p	74LS366	65p	74LS447	1.85p
74LS20	20p	74LS63	1.50p	74LS114	45p	74LS158	60p	74LS194	1.00p	74LS260	45p	74LS367	65p	74LS490	1.60p
74LS21	22p	74LS73	45p	74LS122	75p	74LS160	90p	74LS195	1.10p	74LS261	4.25p	74LS368	65p	74LS668	1.05p
74LS22	22p	74LS74	28p	74LS123	75p	74LS161	75p	74LS196	1.20p	74LS266	45p	74LS373	1.55p	74LS669	1.05p
		74LS75	36p	74LS124	145p	74LS162	1.15p	74LS197	95p	74LS273	1.75p	74LS374	1.80p	74LS670	2.50p

Intex DATALOG LTD

INTEX DATALOG announce the 'PC-BASIC' BASIC compiler for the CBM range of microcomputers

- A program which has been SAVED normally on disk is compiled back onto disk into a directly loadable program file. The compiler is completely written in machine code and is fully compatible with CBM-Microsoft interpreted BASIC.
- It supports all BASIC commands and all CBM peripherals.
- The largest program that can be compiled is about 28K (depending on its structure).
- The increase in speed depends again on the type of program, but P.C.W. benchmark tests indicate that a compiled program will run at up to 10 times faster than its interpreted equivalent.
- Extra facilities available in a compiled program include:- 1) Integer loops for faster execution. 2) RUN/STOP disable/enable command. 3) Optional fully formatted listing of the program as it is compiled. 4) Optional production of a cross reference table of variables and line references at compilation. FULL DETAILS ON REQUEST.

ITEM	PRICE	TOTAL INC. VAT.	ITEM	PRICE	TOTAL INC. VAT.	ITEM	PRICE	TOTAL INC. VAT.	ITEM	PRICE	TOTAL INC. VAT.
DUSTCOVERS			RIBBONS			COMPUTHINK EX. DEMO. DISK UNITS 3000 SERIES			BOOKS		
PET - ALL MODELS	5.75	6.90	TELETYPE 43	7.72	9.17	400K DISK DRIVES	695.00	799.25	PET & THE IEEE 488 BUS		9.95
T/143 PRINTER	5.75	6.90	ANADIX DP8000	2.75	3.45	800K DISK DRIVES	895.00	1029.25	PROGRAMMING A MICRO 6502		7.25
ANADIX DP8000	3.50	4.35	CBM 3022	2.75	3.45	APPLE SOFTWARE - ON DISKETTE			A QUICK LOOK AT BASIC		8.95
CBM 3040 DISK (4040/8050)	3.50	4.35	QUME (FABRIC)	4.25	5.18	25% OFF LIST PRICE - VAT			TTL COOKBOOK		7.15
CBM 3022 PRINTER	3.99	4.80	QUME (CARBON M/S)	4.50	5.46				TTL EXPERIMENTS VOL 1		7.25
COMPUTHINK DISK	3.00	3.75	QUME (CARBON S/S)	5.00	6.04				TTL EXPERIMENTS VOL 2		7.25
ACOUSTIC COVER FOR CBM 3022 PRINTER	49.00	62.00	DAISY WHEELS	6.50	7.76				TV TYPEWRITER COOKBOOK		7.25
D/D DISKETTES IN FREE CASE			PET ENHANCEMENT UNIT						555 TIMER		5.35
BASF	35.00	40.83	INCLUDES	45.00	51.75				PROGRAMMING THE 6502		8.75
VERBATIM	30.00	35.08	REPEAT KEYS KEY CLICK RESET KEY MUSIC FACILITY						6502 APPLICATION BOOK		8.75
LIBRARY CASE	3.50	4.60	FOR 3/4000 SERIES ONLY						ACCENT ON BASIC		4.95
BLANK CASSETTES			PROGRAMMERS TOOLKITS	15.00	17.25				ADVANCED BASIC		6.85
C15 (PER 10)	4.00	5.75	PET DIGITIZER	10.00	11.50				BASIC BASIC		6.75
C60 (PER 10)	6.00	8.05	REPEAT KEY	5.00	5.75				BASIC COMPUTER GAMES		5.50
CONNECTORS			PETSET 1 A to D CONVERTER	99.00	113.85				THE BASIC HANDBOOK		11.00
USER/IEEE PORT	1.30	1.78	TCM 100 PRINTER WITH APPLE INTERFACE (Ex Demo)	200.00	230.00				BASIC PRIMER		6.95
CASSETTE PORT	99	1.43	PAPER PRINTOUT TRAY						BASIC PRIMER		6.95
USER PORT COVER	2.50	3.16	FORMS RECEIVING TRAY						BASIC PROGS. FOR PET		10.95
MALE D PLUGS	2.50	3.16	(CBM 3022 DP8000 MICROTEK)	17.00	19.55				6502 ASSEMBLY LANG. PROG.		10.50
FEMALE D SOCKETS	3.50	4.31							PROGS. IN BASIC FOR ELECT ENG		4.35
D CONNECTOR COVERS	2.50	3.16							PROG. & INTERFACING THE 6502		8.95
									PET LIBRARY OF SUBROUTINES		10.00
									PET LIBRARY OF SUBROUTINE DISK		11.50



Barclaycard
& Access
Welcome

Showroom
& Mail
Order
Departments

Commodore
& Pet
Software

Appleware
&
Nascom

Leasing, Hire
Purchase, Short
Time Hire, ask for
written details

Books, Manuals,
Accessories, Paper,
Diskettes, Cassettes.

Eaglescliffe Ind. Est. Stockton

Cleveland TS16 0PN Tel(0642) 781193

Intex

Matrix Rom for Pet £35 plus VAT

NEW FROM STACK

For all Dynamic RAM PETS (3008-3032, 4008-4032, 8032)
(state which)

- 1 Matrix 1 = Matrix 2
- 2 Matrix 1 = Matrix 2 + Matrix 3
- 3 Matrix 1 = Matrix 2 - Matrix 3
- 4 Matrix 1 = Matrix 2 * Matrix 3
- 5 Matrix 1 = Expression * Matrix 2

- * Matrix Functions on a chip see detailed panels
- * Fully integrated with Basic
- * Does not interfere with toolkit
- * Fits in right hand ROM slot
- * Fast machine code operation
- * Repeat key
- * Simple easy to use instructions
- * A must for scientific, statistical and mathematical users

- 6 Matrix 1 = Transpose (Matrix 2)
- 7 Matrix 1 = Zero Matrix
- 8 Matrix 1 = Unity Matrix
- 9 Matrix 1 = Identity Matrix
- 10 Repeat Key Function

To Stack Computer Services Ltd

- ☐ Please supply () Matrix Roms for Pet Model
- ☐ I enclose a cheque for £
- ☐ Please add me to your mailing list.

Stack Computer Services Ltd
290-298 Derby Rd, Bootle, Merseyside **051 933 5511**

Trade enquiries welcome.



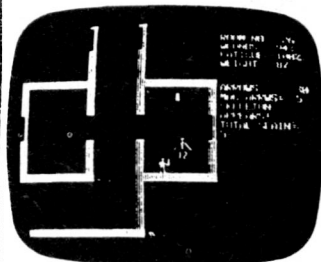
To order State which model Pet and send a cheque for £40.25 payable to **Stack Computer Services Ltd.**

**ANOTHER USEFUL
PRODUCT FROM
STACK**

APPLE :: PET :: TRS Software



DUNJONQUEST Temple of Apshai



Temple of Apshai during play on the Apple computer.

Graphics!
(Apple uses high-resolution & color!)

Real time!

A fantasy role-playing experience!

For ages 10 through adult

Complexity: Intermediate

Playing time: 30 minutes to forever!

For one player

Now, you can enter a universe in which quick wit, the strength of your sword arm and a talisman around your neck might be what separates you from a pharaoh's priceless treasure—or the death-grip mandibles of a giant mantis.

"Temple:..." is a role-playing game (RPG) that catapults you into a world of magic and monsters—doomed cities and damsels in distress. More than a game, it's an alter-ego experience. In an RPG, complex factors that make up a human being are abstracted into a few basic characteristics: strength, constitution, dexterity, intelligence and ego. Via your role-playing character, you'll venture into an essentially unknown world, and be at home with the likes of skeletons, zombies, spiders and wraiths. You'll bargain with a tight-fisted innkeeper for the weapons and armor you'll need in the dunjon.

When you play the "Temple of Apshai," you'll be both a character within and a reader of the epic you're actually helping to create. In this labyrinth, the choice is always yours... fight or flee, parry or thrust, slay the monsters or see if they'll listen to reason.

After you've bargained for your sword, armor, shield and your bow and arrows, most of your time in the dunjon will be spent exploring the 200 rooms on four different levels... trying to find 80 types of treasures of priceless worth. But wait—the treasures are surrounded by traps—needles, daggers, flames and bottomless pits—closely guarded by monsters vile and noxious. Do you dare to thrust your broadsword at the giant leech, the skeletal bat, the zombies or the ghouls with mouths full of razor fangs?

We invite you to project yourself into the labyrinth. See and touch the treasures, hear and smell the creatures that inhabit the place. Discover for yourself the fantasy world of Apshai!

ALGRAY

ALGRAY House, 33 Bradbury Street, Barnsley.
South Yorkshire Tel: Barnsley (0226) 83199

TR880
16k LII;

PET 32k
Case

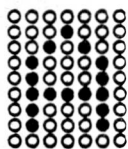
14.95

TR8008
32k;

APPLE
48k
(Disk)

16.95

All prices
include p & p
and V.A.T.



MICROS MEMORIES TTLs AND INTERFACE DEVICES

Z80	£5.50	6800	£3.75	6502	£5.50
Z80A	£6.50	6802	£6.50	6502A	£7.50
8085A	£6.50	6809	£16.00	2650A	£16.00
Z80CTC	£4.50	8205	£2.20	6522	£5.50
Z80ACTC	£5.50	8212	£1.80	6532	£8.00
Z80DMA	£12.00	8216	£1.80	6821	£1.80
Z80ADMA	£15.00	8224	£2.50	6845	£10.00
Z80 ADART	£15.00	8228	£2.50	6850	£1.80
Z80 PIO	£4.50	8251	£4.00	6852	£2.50
Z80A PIO	£5.50	8255	£4.00	6875	£6.00
Z80 SIO-1	£24.00	8279	£9.50		

Large range of PERIPHERAL devices available.

SPECIAL OFFERS

	1-24	25-99	100
2114L — 450ns	£1.30	£1.20	£1.10
2114L — 200ns	£1.60	£1.50	£1.40
2716 (+5v)	£3.00	£2.75	£2.50
2732 (+5v)	£8.00	£7.50	£7.00
2532 (+5v)	£8.00	£7.50	£7.00
4116 — 200ns	£1.30	£1.20	£1.10

SPEECH SYNTHESISER

(A PROJECT BY TEXAS INSTRUMENTS LTD)

Superb major solid state speech project for under £100 Promises to have a dramatic impact on State-of-Art Electronics — now, and for generations to come A talking library of over 200 words with room for expansion.

Easy interfacing to a microcomputer Pitch control has exciting electronic music applications. (A Reprint of original constructional article in E & MM (June 81) available at 65p + large SAE) COMPLETE KIT (inc. PCB) £87.00 (NB. We are fully authorised TEXAS INSTRUMENT distributor for the above project)

ACORN ATOM: Basic Atom Kit £120, Built £150
SOFTY (Ideal for software development) Kit £99,
Built £120

EXPANSION PCB: A low cost plated thru board for 8k RAM (2114) plus 4 sockets for 2716, 2732 or 2532 Fully buffered and decoded lay-out. Ideal for UK 101 and Superboard. Suitable for other computers £17.50

UK101 : INTERFACING COMPUKIT DECODING MODULE KIT £27.50 ANALOGUE BOARD KIT £47

The analogue board kit includes D/A converter, 8-channel A/D couverter, AY-3-8910 Prog. Sound Generator, 6522 VIA giving timing and counting functions plus extra 16 bit part

PLEASE ADD P & P 40p AND VAT AT 15%

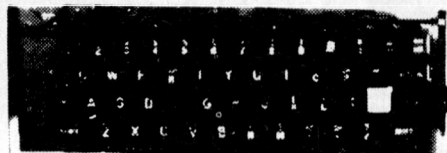
TECHNOMATIC LIMITED

RETAIL SHOPS:
17 BURNLEY ROAD
LONDON NW10

305 EDGWARE ROAD
LONDON W2
Tel: 01-723 0233

MAIL ORDER
17 BURNLEY ROAD
LONDON NW10
Tel: 01-452 1500/450 6597
Telex: 922800

Professional ASCII Keyboards



ONLY
£29.95
+ VAT
SCOOP

The 'CHERRY' Computer Keyboard

- 52 KEY 7 BIT ASCII CODED
- POSITIVE STROBE +5V - 12V
- FULL ASCII CHARACTERS
- PARALLEL OUTPUT WITH STROBE
- POWER LIGHT ON CONTROL
- NATIONAL mm 5740 CHIP TTL OUTPUT
- SUPERBLY MADE SIZE 12x5 5x1 5ins
- BLACK KEYS WITH WHITE LEDGENS
- ESCAPE SHIFT RETURN & RESET KEYS

Complete with CIRCUIT & DATA

Ideal for use with TANGERINE

TRITON

Ex-Stock from HENRY'S TUSCAN

APPLE & most computers

This is definitely the **BEST BUY**

Supplied **Brand NEW** in manufacturers original jacking
(ANTI-STATIC)

Just post remittance total £35.95 (incl. VAT & Post)



HENRY'S



Computer Kit Division

404 Edgware Road, London, W2, England
01-402 6822

LONDON SW1

Based in the heart of Westminster, Logic Box is well-positioned to supply all your microcomputer requirements. As specialists in Commodore PET and APPLE we provide a complete service to any company looking at microcomputer as a serious business tool, and will be happy to supply:

- * PET and APPLE hardware and peripherals,
- * a wide range of dot-matrix and letter quality printers,
- * packaged software for business planning, accounting, stock control, payroll, word processing and data management,
- * customised software,
- * operator training,
- * full after sales and maintenance service.

If you are interested in any of the above please contact us for further details.

LOGIC BOX LTD
31 PALMER STREET
LONDON SW1
(near St James's Park underground)
Tel: 01-222 1122/5492



MICRO-80

UK Subscription Dept.

24 Woodhill Park Pembury Tunbridge Wells Kent TN2 4NW

DO YOU KNOW the cure for the Summer Time Blues?

PERK-UP your computing with a subscription to MICRO-80.

EVERY MONTH we publish at least one application program in Level I BASIC, one in Level II BASIC and one in DISK BASIC (or disk compatible Level II) plus utility programs in Level II BASIC and Machine Language

MICRO-80. The specialist monthly magazine for the TRS-80 and Video Genie user.

Please send me a sample copy. I enclose £1.50 ☐

or Please enrol me for an annual subscription. I enclose £16.00 ☐

(tick the box and enclose your cheque/P.O. made payable to MICRO-80 for the correct amount and send to the above address)

Name

BLOCK CAPITALS PLEASE

Address

.....



Some new introductions by the Midlands Computer Centre...

We celebrate our first birthday with news of new introductions available from the Micro Computer Centre.

NEW

HORIZON

NEW

CROMEMCO

In addition to Nascom and Commodore micro computers

PERIPHERALS

(Excluding printers)

Sharp Cassette Decks. Crofton 10" Cased Monitors.

PRINTERS

Nexos Ricoh RP 1600 Daisy Wheel Printer. Diablo Daisy Wheel Printer. Nascom Micro Imp. Dot Matrix Plain Paper Printer. Centronics Dot Matrix. Anadex Dot Matrix. Newbury Laboratories Dot Matrix Impact Printer.

ADD-ONS FOR NASCOM

Input/Output Board. PIO Kit. Counter Timer Kit. UART Kit. (Colour Board Programmable Character Generator Board. Floppy Disc System (Single Drive) available in September). Nas-Pen Text editor. ZEAP 2.0 in EPROM or on Tape. Nas-Sys 3 Enhanced version of Nas-Sys 1. Nas-Dis - Disassembler. Debug - Dynamic Debugger.

BITs & PCs

Tool Kit. Port Probe. Hex Key Pad.

WILLIAM STUART

Colour Graphics for Nascom 1 & 2.

MERSEYSIDE NASCOM USER GROUP

ROM/EPROM Board for Nasbus.

EXTRAS

Henry's EPROM Burner. Antex Soldering Irons & Bits.

SOFTWARE

Northstar. CAP-CPP. Cromemco. Petsoft. Supersoft. Nascom Games.

BOOKS

Very full range of books on 6502, Z80, Languages, Interfacing, Introductory books and games and General Programs.

MAGAZINES

Personal Computer World. Computing Today. Practical Computing. Educational Computing. Liverpool Software Gazette. Printout.

ASK ABOUT THE KENILWORTH CASE

The "Kenilworth" Case. Microtype Case. Veroframe.

BUSINESS & LEISURE MICROCOMPUTERS

Castle Interface.

Business & Leisure Micro Computers

16 The Square, Kenilworth, Warwickshire CV8 1EB. Tel: (0926) 512127

P. & R COMPUTER SHOP

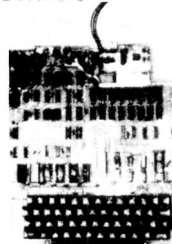
EPSON MX-80 80.GPs. DOT MATRIX PRINTER WITH SPECIAL INTERFACES. 3982 IBM I/O PRINTERS. VDU's. ASCII KEYBOARDS. ASR. KSR, TELETYPES. PAPER TAPE READERS PAPER TAPE PUNCHES. SCOPES. TYPEWRITERS. FANS 4" 5" 6". POWER SUPPLIES. STORE CORES, TEST EQUIPMENT, AND MISCELLANEOUS COMPUTER EQUIPMENT. OPEN:- MON TO FRI 9am-5pm SATURDAY TILL 1pm.

COME AND LOOK AROUND

**SOLCOTT MILL, GOLDHANGER RD,
HEYBRIDGE, ESSEX.
PHONE MALDON 57440**

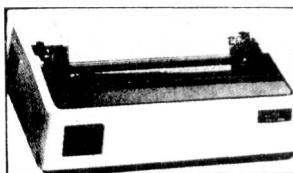
OHIO SCIENTIFIC COMPUTERS

SUPERBOARD 3



Superboard 3 £159. Power supply kit £11.95. Modulator £3.50. Guard band kit £10. 4K extra ram £15.60. Case £27. Cassette recorder £18. Cegnon improved monitor rom £29.50. Assembler/Editor tape £25. Word processor program £10. Display expansion kit 30 lines x 54 characters for Superboard 2 (not 3) £14. Vemco £19.95. Centronics interface kit £10.

PRINTERS



Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard:- OKI Micro-line 80 (illustrated) £299. Epson MX80 tractor £359. Epson MX80 tractor friction £399. Epson MX80 £279. Epson TX80 £295. Seikosha GP80 £199.

CHEAPO EXPANSION OFFER

Buy a 610 expansion board with 8K ram on board and space for another 16K for £159 and get a free 5V 3A power kit and any extra ram you want for £3/K. Buy a mini-floppy + case + power supply + 2 copies of DOS for £275 and we will do the extra ram for £2/K (Max 16K). We can also supply a version to suit UK101.

SPECIAL OFFER

Superboard 3 + power supply and modulator kit + guard band kit (converts the display to 32x32, gives 1200 and 300 Baud tape speeds, increases computing speed by 50% and converts to 50 Hz). Only £172.

SERIES 2

CHALLENGER

Microcase versions 4K £212. 8K £228. Postage £4.50 extra

5V POWER KITS

Fully stabilized 5V computer and TTL power kits. Automatic current limiting and short circuit protection. Crowbar over-voltage protection. 1 1/2A £7.83, 3A £12.17, 6A £19.13.

MEMORY CHIPS

2114 450ns £1.95. 4116 200ns £199. 4027 £1.30 All low current.

SWANLEY ELECTRONICS

Dept. PCW, 32 Goldsel Rd, Swanley, Kent BR8 8EZ. Postage £3.50 on Superboard, £4.50 on printers and 45p on orders. Lists 27p post free. Please add VAT to all prices. Official credit orders welcome. ZX81 part exchange possible.

Mini-Digital Recorder

THE FAST AND SIMPLE ALTERNATIVE TO DISC

- High Read/Write speed — 6000 baud (10-20 times faster than audio cassette)
- High data integrity (error better than 1:107)
- No keys — under software control — facilities normally only available with disc
- Uses proven Philips mechanism
- Large capacity — up to 120K bytes
- Additional RAM and ROM
- Firmware included
- Robust construction/Attractive appearance
- Compatible with 6502 based computers including PET, AIM 65, KIM, OHIO, COMPUKIT etc



£195 + £2.75 p.p. + VAT

CURRAH COMPUTER COMPONENTS

SANDGATE INDUS EST, HARTLEPOOL
CLEVELAND TS25 1UB
Telephone (0429) 72996

Also Available (Prices Excluding VAT)

Tape Cassettes (boxes of six)	£15.90
MDCR 220 Mechanism	£83.00
Interface Board (1 MHz)	£42.50
Memory Board with Firmware	£45.00

Old tricks for new Pets...

COMMAND-O is a FOUR KILOBYTE Rom for the 4000/8000 Basic 4 Pets with all the "Toolkit" commands RENUMBER (improved), AUTO, DUMP, DELETE, FIND (improved), HELP, TRACE (improved & includes STEP), and OFF - plus PRINT USING - plus four extra disk commands INITIALIZE, MERGE, EXECUTE, and SEND - plus extra editing commands SCROLL, MOVE, OUT, BEEP, and KILL - plus SET user-definable soft key, 190 characters - plus program scroll up and down - plus 8032 control characters on key. Ask for Model CO-80N for the 8032 or CO-40N for the 4016/4032. £50.00 plus Vat

New tricks for old Pets...

DISK-O-PRO is a FOUR KILOBYTE Rom that upgrades 2000/3000 Pets, but lets you keep all your old software - including Toolkit. As well as REPEAT KEYS and PRINT USING, you get all the Basic 4 disk commands CONCAT, DOPEN, DCLOSE, RECORD, HEADER, COLLECT, BACKUP, COPY, APPEND, DSAVE, DLOAD, CATALOG, RENAME, SCRATCH and DIRECTORY - plus extra disk commands INITIALIZE, MERGE, EXECUTE and SEND - plus extra editing commands SCROLL, MOVE, OUT, BEEP and KILL - plus SET user definable soft-key, 80 characters - plus program scroll-up and scroll-down. We recommend the 4040 disk or upgraded 3040 for full benefit of disk commands. Ask for Model DOP-16N for new Pets 2001-3032, and 2001-8 with retrofit Roms & TK160P Toolkit. £50.00 plus Vat, other models available.

PRONTO-PET hard/soft reset switch for the 3000/4000 Pets. We don't think you'll "crash" your Pet using our software, but if you do the Pronto-Pet will get you out! Also clears the Pet for the next job, without that nasty off/on power surge. £9.99 + Vat

and no tricks missed!

KRAM Keyed Random Access Method. Kid your Pet it's an IBM! VSAM disk handling for 3032/4032/8032 Pets with 3040/4040/8050 disks means you retrieve your data FAST, by NAME - no tracks, sectors or blocks to worry about. Over 2,500 users worldwide have joined the "Klub"! Now you can too, at the 1981 price, £75.00 plus Vat.

SPACEMAKER All our Rom products are compatible with each other, but should you want, say, Wordpro with Kram, or Disk-o-pro with Visicalc, then SPACEMAKER will allow both Roms to address one Rom socket, with just the flip of a switch, for £22.50 plus Vat.

We are sole UK distributors for all these fine products. If your CBM dealer is out of stock, they are available by mail from us, by cheque/Access/Barclaycard (UK post paid) or send for details.

Calco Software

Lakeside House Kingston Hill Surrey KT27QT Tel 01-546-7256

SOFTWARE ITT 2020 HARDWARE
COMPUTHINK APPLICATIONS
SPINWRITER PAYROLL ANADEx
DOLPHIN PET PALSOFT
WORD PROCESSING NETWORKS
LEDGERS
KING OF THE JUNGLE

Lion has tamed the microcomputer market by amassing a wealth of experience in micro-based small business systems, and by selecting the best systems available to market and support.

Lion's Business Systems Division is ready to demonstrate the power and flexibility of the micro in commercial applications, and is backed by Lion's established reputation for professionalism and support.

Phone now, at either location, to arrange a demonstration to show how micro's can help you, and why Lion is King of the Jungle.

Credit cards welcome and lease facilities available.

LION MICRO-COMPUTER SHOPS LTD.



At Lion House

227 Tottenham Court Road London W1P 0HX Tel: 01-580 7383
21 Bond Street Brighton Tel: (0273) 601838



GATE POST

- ASTEROIDS IN SPACE (32K-d)** Blas approaching Asteroids — beware aliens £12.00
- HORRIBLESCOPE (32K-d)** Funniest horoscopes, great for parties! Includes your own insults! £10.75
- SPACE (48K-3)** Simulation of human life in space. You develop characters — 6 games £18.00
- SPACE II (48K-D)** A continuation of SPACE, with more characters and games £15.00
- ADVENTURELAND (32K-C)** An enchanted world of lost treasures, wild animals — magical beings £9.00
- PIRATE ADVENTURE (32K-C)** Can you recover Long John's lost treasure? £9.00
- ADVENTURELAND AND PIRATE ADVENTURE (48K)** Both games on one disk £16.00
- FASTGAMMON (M-24K-C or D)** Best computer backgammon available, with sound, hires graphics and cartoons. C £13.00 D £15.00
- TEMPLE OF APSHA! (48K-D)** Mythical labyrinth with fearsome monsters & treasure £18.00
- THE WIZARD AND THE PRINCESS (48K-D)** Best game ever! 100's of beautiful Hires pictures. It is possible to win! — We haven't done it yet £20.50
- DATESTONES OF RYN (48K-C or D)** Built in scoring system — beat your friends. C £9.25 D £12.00
- "MYSTERY HOUSE" HI-RES ADVENTURE (M-48K-D)** See each room in 3D-type graphics £15.00
- CONEY ISLAND (16K-c)** 22 Fast paddle games for 1 or 2 players. Colour graphics £8.00
- OTHELLO (16K-C)** — by Softeq — the best Othello game we've seen £9.00
- SAUCER WARS (24K-C)** Oneperson game, with 150 levels of difficulty £11.25
- VOYAGER EXCURSION (24K-C)** Hires lunar landing game £11.25
- FORTE (16K-C)** A music language — You can save your songs £12.25
- APPLE TALKER (M-16K-C)** Create programmes so your Apple talks to you £9.75
- APPLE LIS'NER (M-16K-c)** Create programmes which understand up to 31 spoken words £12.25
- TALKER and LIS'NER** are compatible with each other
- GOLF (20K-C)** 18 holes for 1 or 2 players — full choice of clubs and direction £5.00
- AIR FLIGHT SIMULATION (16K-C)** only £6.50
- OIL TYCOON (16K-C)** only £6.50
- WINDFALL (32K-C)** The oil crisis game £9.25
- B-1 NUCLEAR BOMBER (16K-C)** Fly this Russian defences — and back! £9.25
- NORTH ATLANTIC CONVOY RAIDER (16K-C)** The Bismark convoy raid of 1941 £9.25
- ELECTRIC CRAYON (8K-C)** Full colour graphics editor £11.00
- U-DRAW (16K-C)** Hires graphics editor £11.00
- MUSIC BOX (8K-C)** Full 3 octaves by semitones, Note-time, rests, tempo + full colour eight show! £9.50
- MAZE GAME (16K-C)** 3-D Colour Maze Game £9.50
- RACER (24K-C)** Best arcade racing game — Hires graphics £8.00
- BREAKTHRU (M-16K-C)** only £6.50
- SPIDER TAG (M-16K-C)** only £6.50
- ATOMIC CASINO (16K-C)** only £5.00
- HIRES BASEBALL (M-16K-C)** £10.25
- E.S.P. (32K-C)** Test yourself — Telepathy and Psycho-kinesis £6.00
- NETWORK (48K-D)** For 2 players — Try and programme a TV network £12.00
- THE COUNT (32K-C)** You awake in a brass bed — in a castle — in Transylvania! £9.00
- VOODOO CASTLE (32K-C)** Rescue Count Cristo from his fiendish curse! £9.00
- STRANGE ODYSSEY (32K-C)** Escape from an ancient alien civilisation £9.00
- ALL THREE ABOVE GAMES ON ONE DISK** £25.00
- MYSTERY FUN HOUSE (32K-C)** Days of fun, but very difficult! £9.00
- AKALABETH (48K-D)** 10 Hires monsters, infinite dungeons, perfect perspective £21.50
- FRACAS (32K-C or D)** up to 8 players — monsters, sound — great! £13.00 D £15.00
- BATTLESHIP COMMANDER (32K — C or D)** Strategy with sound, cartoons & lights! C £10.00 D £12.00
- HELLFIRE WARRIOR (48K-D)** A dreamworld of danger — very difficult! £21.25
- ASTRO APPLE (32K-D)** A serious horoscope £12.50
- THE PRISONER (48K-D)** A nightmare world of 1984 — avoid brainwashing! £19.25
- COMPUTER NAPOLEONICS (48K-D)** Traditional war game — meticulous detail £37.75
- ACANTHOPTERYGIAN FORTUNE TELLING (22K-D)** Great for parties! £10.75
- SARGON II (M-24K-D)** The champ — No better chess for the Apple £21.25
- COMPUTER BISMARCK (48K-D)** Accurate simulation of epic battle £37.75
- A2-FS1 FLIGHT SIMULATOR (M-34K-D)** Extended and improved version, including British ACE 3D Aerial Battle Game only £21.00

PLUS LOTS MORE!! S.A.E. for full list

All programmes in Applesoft, unless M (machine code)
C — on cassette D — on diskette

VAT ALREADY INCLUDED!! Just add 50p P and P to your order and send with cheque /P.O. to:—

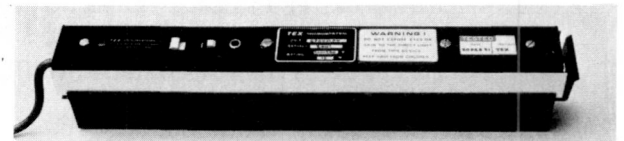


GATE MICROSYSTEMS LIMITED

The Nethergate Centre,
35 Yeaman Shore,
Dundee.

New!

EPROM ERASER - £40



- THIS IS OUR NEW 'EPROMPT GT' MODEL EPROM CHIP ERASER.
- A SAFETY-INTERLOCK SWITCH AND TESTED LIGHT-PROOFING ENSURE LOW RISK OF ACCIDENTAL EXPOSURE TO DIRECT UV.
- IT RUNS COOL AT THE EXACT WAVELENGTH FOR ALL EPROMS.
- IT WILL ERASE UP TO 32 EPROM CHIPS IN 30 MINUTES.
- IT OPERATES ON 200-250V A.C. LINE AT ABOUT 20 WATTS
- ★ AND IT COSTS ONLY £49 INCLUDING SHIPPING AND VAT.

New!

ERASE TIMER £15



- THIS IS OUR NEW 'TEXTIME' SOLID-STATE POWER-DOWN TIMER.
- IT CAN TIME-OUT POWER TO MOST TYPES OF EPROM ERASER.
- IT RUNS ON 200-250V A.C. AND INCLUDES A ½ AMP FUSE.
- IT HAS TWO PUSHBUTTONS AND AN AMBER TIMING LIGHT.
- THE GREEN BUTTON TURNS IT ON TO POWER-UP THE LOAD;
- IT POWERS ITSELF DOWN ABOUT 30 MINUTES LATER; OR YOU CAN PUSH THE RED BUTTON TO TURN IT OFF SOONER.
- IT IS LIGHTWEIGHT, COMPACT, SAFE AND TOTALLY RELIABLE
- ★ AND IT COSTS ONLY £19 INCLUDING SHIPPING AND VAT.
- 'TEXTIME' ALSO SUITS ANY A.C. LOAD TO 100 WATTS AND CAN INCLUDE ANY FIXED OR VARIABLE TIMING TO ORDER.

★ SPECIAL OFFER: 'EPROMPT GT' + 'TEXTIME' £66 INCLUSIVE.

We are the manufacturers and you can buy direct from us. Mail-order prices: Eraser £49. Timer £19 all inclusive. Terms C.W.O. or C.O.D. (add £1) or trade references please. Educational & Public Authorities obtain immediate credit.

All orders and enquiries post-free to:—

TEX MICROSYSTEMS LTD. FREEPOST
ST. ALBANS, HERTS. AL1 1BR ST. ALBANS 64077/TRING 4797 ANYTIME

Master Your Micro FAST with...

Little Genius floppy diskette based courses will teach you, how to use your system and how to realise the full potential of the "Mighty Micro". These fully interactive computer lessons will guide you quickly to a high level of understanding and confidence in your ability to make the most of your microcomputer system.

Courses now available:

- Applesoft BASIC
- Advanced Applesoft BASIC
- Using your Apple
- Palsoft BASIC
- Advanced Palsoft BASIC
- Using your 2020
- PET BASIC
- Advanced PET BASIC

Little Genius

Each course, comprising a floppy diskette, and starting instructions, costs only £40.00 plus VAT.

SPECIAL "3 in one" OFFER for 3 courses covering the same system only £99.00 plus VAT.

Little Genius courses are available from most computer retail outlets, or direct mail order from:

LITTLE GENIUS

Suite 504, Albany House, 324 Regent Street, London W1R 5AA.
Telephone: 01-580 6361



SHARP 3201 COMPUTER

FROM £2950



Come and try it, and TEST
the sensational software

NorthStar BUSINESS SYSTEM

with SPINWRITER, WORDSTAR, complete only £4400

MZ-80K Video Genie

BOOKS PC1211s + printer SOFTWARE

EPSON PRINTERS	MX80 F/T	£395
	MX80 T	£345
all interface available	MX70	£255

PHONE CHRIS ROBINSON ON (0473) 50152 All prices EXCLUDE VAT & delivery

MICROTEK

15 LOWER BROOK ST, IPSWICH, SUFFOLK



Happy Memories

4116 200ns	£1.70	2114 200ns	£2.95
2114 450ns	£1.95	2716 5V	£3.70
2708 450ns	£3.35		

Soft-sectored mini-discs with free
plastic library case £19.95 per 10.

Low profile I.C. sockets:

Pins: 8 14 16 18 20 22 24 28 40
Pence: 10 11 12 16 17 19 21 28 37

Memory Upgrade Kits for
TRS-80, Apple, 20-20 etc
from £13.60

Please phone (054-422) 618

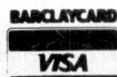
ALL PRICES VAT INCLUSIVE

Please add 30p postage to orders under £15.
Government + Educational orders welcome
£15 minimum

Dept PCW

Happy Memories
Gladestry
Kington
Herefordshire
HR5 3NY

Tel: (054 422) 618



BITS & P.C.S.

COMPUTER PRODUCTS LTD

The North's Leading Nascom Specialist

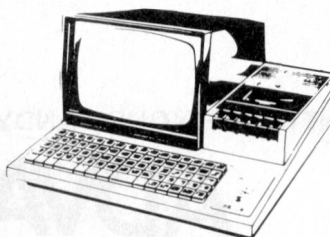
**FULL RANGE STOCKED
NASCOM SERVICE & ADVICE
OUR SPECIALITY**

**See the Nascom Distributor ads
for full details**

****NEW FOR NASCOM 1**
THE Mk11 BITS & P.C.S. GRAPHICS
SYSTEM GIVES NASCOM 2
GRAPHICS ON A NASCOM 1.**



**Quantum Micros HIGH
RESOLUTION
GRAPHICS FOR
MZ80K**



FULLY COMPATIBLE
WITH EXISTING
SOFTWARE/
HARDWARE
BUILT & TESTED UNIT.

COMPLETE WITH DEMO SOFTWARE &
EDITOR. RESOLUTION DOWN TO 1 DOT
LARGE SAE FOR FULL DETAILS



WE STOCK THE FULL MZ80K RANGE
AT COMPETITIVE PRICES



Software for MZ80K £7.00 each

- GAMES (1)** Star Trek, Spacefighter, Stock car, Labyrinth, Reverse, Test.
- GAMES (2)** Electric organ, Othello, Ambush, Fox & hounds, Metric conversions, Hangman, Shuffle.
- GAMES (3)** Ten pin, War, Swamp, Minefield, Biorythm, Scramble.
- GAMES (4)** Paper stone, Jumping balls, Bounce, Race, Calendar, Alarm clock, One armed bandit.
- GAMES (5)** Poker, Stamp, Obstacle, Battleships, Surround, Animal.

PC1211 POCKET COMPUTER £96.00 inc VAT
**PC1211 POCKET COMPUTER
PRINTER £88.00 inc VAT**
PC1211 CASS INTERFACE £16.95 inc VAT

BITS & P.C.s Computer Products Ltd.
4 Westgate, Wetherby, West Yorkshire.
LS22 4LL Tel: 0937 63744.

SAE for details: prices include VAT and postage and
package.



NEW NEW NEW NEW NEW

HE GAVE YOU THE FANTASTIC BEST SELLER ARCADE INVADERS, BUT NOW MIKE CHALK HAS EXCELLED EVEN THAT WITH ANOTHER 'ARCADE' GAME.

U-BOAT STRIKE !!

Again, it's a fast moving, all-action genuine arcade game, with you as the U-boat captain sinking the enemy ships, by either single or volleys of torpedoes.

There are no less than 16 different types of ships travelling at various speeds and distances — and what is unique — in both directions!

The convoy is protected by destroyers which drop clusters of depth charges, modern ones, which home onto the last position from where you fired, and which of course, unless you move quickly, can put you out of action.

It's all in real-time, with a time limit and scores kept, with the best five displayed together with the names of the players.

The game is like the 'Sea-Wolf' of the Arcades, but better, for Mike has given it much more variation.

IT'S ONLY AVAILABLE FROM KANSAS AT A SENSIBLE £9.50.



UNLEASH THE POTENTIAL OF YOUR TANDY OR VIDEO GENIE WITH LEE EDWARDS' NEW

ADVANCED PROGRAMMING AID

This is one for the serious programmer giving the know-how to get into the realms of advanced programming.

It shows in detail how to manipulate the computer's operating system so you know exactly what does what.

It also describes how and where Basic is stored, so you can use the information to write your own utility programs.

It shows how you can obtain ultra-fast graphics, anywhere around the screen, manipulating by string concatenation.

Also there's a useful graphic block table.

The program gives the secret of being able to actually transfer data from one program to another and how to store it in memory for later use in another program.

You learn how to easily manipulate the cursor around the screen to position it just where you want.

Dissable procedure is explained, showing how to dissable either the whole keyboard or say the Break key. You are shown how to turn off the video. If you loose a program you can learn how to get it back. A keyobard de-bounce is given as is the routine to change Print statements to LPrint and much, much more.

This is not a simple program like the Video Genie program, for beginners, but for those really wanting to upgrade their programming techniques considerably.

IT'S ONLY AVAILBE FROM KANSAS AT A REMARKABLE £12.50

Kansas

Kansas City Systems, Unit 3, Sutton Springs Wood, Chesterfield, Derbys. Tel 0246 850357

All prices VAT paid and post free. First class return post service. Barclay-card, Visa orders dispatched same day if phoned in by 3pm. Answering machine ordering service after 6pm and Sundays to allow use of cheap rate. Catalogue available on request.

**The Sinclair ZX80 is innovative and powerful.
Now there's a magazine to help you get
the most out of it.**

Get in sync



SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR\$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR\$(9) and CHR\$(265) will produce identical values. In other words, CHR\$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL\$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions

on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurtle, another game in the charter issue, you have to find a happy little Hurtle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurtle sends out a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, **SYNC** to be a respected and successful magazine.

Order SYNC Today

Right now we need all the help we can get. First of all, we'd like you to subscribe to **SYNC**. Subscriptions are posted by air directly from America and cost just £10 for one year (6 issues), £18 for two years (12 issues) or, if you really want to beat inflation, £25 for three years (18 issues). **SYNC** is available only by subscription; it is not on newsstands. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned: reviews must be in-depth and objective. We want you to respect what you read on the pages of **SYNC** so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

The magazine for Sinclair ZX80 users
SYNC
27 Andrew Close
Stoke Golding
Nuneaton CV13 6EL, England

The 4th Personal Computer World Show

10th-12th September 1981

This year's PCW show is all set to be bigger and more varied than ever before. It will be something like twice the size because we've now taken two floors of the hotel instead of last year's one. With one floor specialising in business, scientific and engineering applications and the other in home and hobby interests, this is definitely the show to see the micro in all its guises — from Space Invaders to word processors, from teaching applications (both floors) to company accounting. And, of course, everything you need to go with it — software, peripherals, power supplies and books — everything in fact to make the best of your personal computer world.

To make sure the show really goes with a swing, it will be organised so that you will know exactly where to go to find the stands that interest you most. Visitors will be given different coloured badges according to their interest. Of course, this won't stop you seeing the whole show, but it will mean that exhibitors can see at a glance who is just browsing and who is a potential buyer.

Of the 46 companies who had booked by the time we went to press, a few even managed to tell us what they'd be doing. Here's a selection:

The business section will comprise more than just computers. *Mind Your Own Business* magazine will be happy to help any baffled businessman who, faced with such an array of systems, doesn't know how to decide which one will be right for him or even what questions to ask the salesman. For PET enthusiasts, 'Squire' Allason will be there with his *Printout* team to provide the latest lowdown on Commodore products.

Among the new products on show will be Commodore's new £200 baby, the VIC, which offers colour graphics and plugs into the domestic TV. Why not visit the stand and get some hands-on experience — and maybe even buy one? Roxburgh Printers will have a mysterious new product on display but

at the moment they're keeping the details a closely guarded secret. Watch this space.

Molimerx knows a good thing when it sees one: ours is the only show that it's attending this year! This company specialises in software for all TRS-80 and Video Genie machines and is sole distributor for Acorn Software of Washington and of the LDOS operating system. With a bit of luck, some of Acorn Software's personnel will be on the stand to answer your questions.

Cetronic will have some interesting devices on its stand, in particular, the constant voltage transformers for personal computers and a shaft position encoder for use with the PET.

Portatel Conversions will have a wide range of Apple products on show and will be highlighting its unique high resolution graphics colour monitors dedicated to the Eurapple and operating without the need for a colour card.

Mapcon-authorized consultants MC Computers is another early booking. Its range of products includes a data acquisition system which can be used in a variety of ways, from measuring temperature in central heating systems to the monitoring of sheet metal pressing processes.

Among the exhibitors of business applications is Beta Systems who will have an interesting selection based on the Apple, including one for commodity brokers and another for hotel reservations. Tandy tells us that it will have the entire TRS-80 range there as well as many business packages.

Popping downstairs to the lower floor, you'll find a number of clubs and, of course, ComputerTown UK! — more about that next month. The European Microcomputer Chess Championship should make rivetting viewing, too. DAI has just announced that it will be awarding the first prize in our IYDP competition at the show. The lucky winner will be notified in mid-August.

Remember, there will be something for everybody at the 4th PCW Show.

So, whatever your interests — whether you want to learn Basic, shoot silicon Martians or automate your payroll — make a note in your diary right now.

Companies booked at the time of going to press:

- Beta Systems
- Cetronic
- Chromasonic
- Community Computers
- Comp Shop
- Computer User Aids
- Contour Computer Systems
- Creative Computing
- Data Applications
- Easicomp
- Elcomp
- Feedback
- A J Harding
- Humac Computer Services
- Ingersoll (Atari)
- Intex Datalog
- Kansas City Systems
- Little Genius
- London Computer Centre
- Lowe Electronics
- LP Enterprises (MPI)
- Macronics
- Maplin
- March Communications
- MC Computers
- Microperipherals
- Mind Your Own Business
- Mine of Information
- NEC Communications
- Newbear
- Personal Computers
- Portatel Conversions
- Printout magazine
- Radio Shack
- Research Machines
- Roxburgh Printers
- SBD Software
- Silica Shop
- Sinclair Research
- Southern Software
- ST Commercial Systems
- Tandy
- Ties Investments
- Vero Electronics
- John Wiley

ADVERTISERS INDEX

Abacus	178,181	Creative Computing	197	Intex Datalog	189	NSC Computer	
Acorn Computers	94	Crofton	179	JS Systems	160	Shops	34
Advanced Computer		Currah	193	Jarogate	22	Nascom Dealers	72
Equipment	130	Currys Micro	8	KAI	170	Newbear Computing	40
Albion Software	178	DJ AI Systems	48	KGB Micros	131	Northamber	4,5
Algray	190	DRG Business Machines	21	Kansas City	196	Online Conferences	118
Almarc Data Systems	123	Datalink	20	Keen	29,31	Oxford Computers	
Anglia Comp Centre	175	Data Plus	106	Keytronics	166	Systems	186
Arfon Micro Electronics	75	Datron Microcentre	182	Kingston Computers	168	P & R Computer Shop	192
Axon	172	Davinci Comp	175	Kram	178	Personal Computers	OBC
BHRA	182	Digico	43	L & J Computers	136	Petalect	9
Bits & Pc's	195	Display Electronics	161	Leicester Comp Centre	88	Pete & Pam Computers	176
Bug Byte	77	EMG	180	Linsac	183	Photo Acoustics	164
Business & Leisure		Easi Comp	183	Lion House	193	Printout	98
Microcomputers	192	Electronics Brokers	40	Little Genius	194	Professional Data	
Butel	88	Elfton	77	Logic Box	191	Systems	170
PCS Data	33	Equinox	120	London Computer		Q-Tek Systems	8
Calisto	42	Essential Software	28	Centre	173	Qume	47
Calco	193	Feedback Instr	49	Lowe Electronics	7	Rair	76
Calona	174	Ferguson Computers	18	Lucas Logic	52	REM	180
Cambridge Comp Store	132	GP Industrial	183	Magtronics	188	SBD	162,164,168
Camden Electronics	172	Gate Microsystems	189	Malvern	175	Science of Cambridge	69
Centronics	35	Gibson	24	Maplin	27	Sharp	19,41
Chromasonic	14,15	Gramma Winter	12,13	Melbourne House		Sinclair Research	124,125
Codified Comp		Great Northern	174	Publishers	79	Spider Software	172
Systems	128	Guestel	171	Memtec	175	Stack	194
Comart	117	HL Audio	39	Micro-80	191	Strumech	26
Commodore	56	Hal	36	Microact	114	Swanley Electronics	192
Commodore VIC	20,2	Happy Memories	195	Microbusiness Centre	188	Technomatic	190
Comp Shop	200,IBC	AJ Harding	16,17	Microbyte	159	Telefusion	187
Compuskill	166	Henry's	191	Microcentre	IFC	Templeman Software	180
Computace	23	Hewlett Packard	32	Microcosm	132	Tex Microsystems	194
Computech	44	Hitech Electronics	167	Microfacilities	25	Thermal Precision	89
Computer Book Club	59	Hunting Computer		Micro General	187	Tomorrow	168
Computer Bookshop	108	Services	186	Micro-K	47	Transam	169
Computer Interfacing		ITT	45	MicroLab	164	Watford Electronics	163
Equipment	174	Independent Computer		Micro Networks	46	Westfarthing Comps	77
Computer Int Designs	176	Engineering	184	Micro Peripherals	83,85	Westwood Comps	77
Computers for All	177	Intelligent Artefacts	174,184	Microstyle	30	Wilkes	140
Computer Supermarket	37	Interam Computer		Microtek	195	Xitan Systems	60
Co-op Soft	160	Systems	92	Microware London	162	Zilog	64
Cream Microcomputer		Interface Components	38	Mike Dennis	181		
Shop	187	Interface Software	165				



Just in case you haven't noticed, we have a new (improved) phone number: 01-631 1433. . . Speculation that Acorn has a 68000-based system in the pipeline was fuelled by the sight of Herman Hauser at a recent Motorola seminar, hobnobbing with that company's technical bigwigs. . . Still on Acorn, Chris Curry calls the BBC micro the 'Beebon'. . . Malcolm Peltu returned from a Monte Carlo jaunt just in time to see one of the computer-controlled boards at Heathrow announce the arrival of a flight from Stuttgart. . . PCW's editor went to hear Philippe Dreyfus explain France's information technology plans — the day following the election of a new President. . . Before making his name in software protection, barrister Alistair Nelman worked for a little-

known firm of solicitors — see the letterhead reproduced elsewhere on this page. . . Latest buzzword from the States is 'snarf', as in 'we just snarf up data from Prestel'. . . Another Silicon Valley favourite is 'set verbosity to zero'. . . Mike Gurr spends his spare time visualising the havoc caused by computer-literate kids when they go to work and find that businesses

haven't even got computers yet. . . Micromole Inc suggests we investigate a rumour that a certain Tangerine director has gone into the demolition business equipped with a brand-new Jaguar XJS. The score so far: a garden wall and a garage. Oddly, Micromole Inc enclosed an unprintable photo of Toady's Diego Rincon. . . Finally, in case

you wondered about that odd cove pictured on page 70, he is Shino Zuka Iga no Kami — one of the 12 heroes of ancient Japan. The painting is by Kuni Yoshi Utagawa and it depicts the hero dressed up as a lance man — one of the shogi pieces.

DEWIE, CHEATHAM & HOWE

Solicitors and Commissioners for Oaths

Vat No.
Swiss Bank No.
Your Ref.
Our Ref.
Date

14 SEVINGTON ROAD
HENDON
LONDON NW4 3SB.
Telephone: 01-202 7245

NEW REDUCED PRICES

16K £449 }
32K £499 } + VAT

RRP £795 for 32K

The PEDIGREE PETS

Very popular for home & business use. 8K Microsoft Basic in ROM. 8K Pet 32K & 16K with new improved keyboard.

Cassette Deck £55 extra Interface PET IEEE —
Centronics Parallel Decoded £77.00 + VAT



NOW IN STOCK

THE NEW & EXCITING TRS80 MODEL III

16K £559 + VAT 32K £589 + VAT 48K £619 + VAT

The Radio Shack TRS-80™ Model III is a ROM-based computer system consisting of:

- A 12-inch screen to display results and other information
 - A 65-key console keyboard for inputting programs and data to the Computer
 - A Z-80 Microprocessor, the "brains" of the system
 - A Real-Time Clock
 - Read Only Memory (ROM) containing the Model III BASIC Language (fully compatible with most Model I BASIC programs)
 - Random Access Memory (RAM) for storage of programs and data while the Computer is on (amount is expandable from "16K" to "48K", optional extra)
 - A Cassette Interface for hard-copy output of programs and data (requires a separate cassette recorder, optional/extra)
 - A Printer Interface for hard-copy output of programs and data (requires a separate line printer, optional/extra)
 - Expansion area for upgrading to a disk-based system (optional/extra)
 - Expansion area for an RS-232-C serial communications interface (optional/extra)
- All these components are contained in a single moulded case, and all are powered via one power cord.

SPECIAL OFFER FOR MODEL III PURCHASERS

We will take keyboards only for TRS80 Model I and Level II in part exchange.

There will be refurbished Model I and Level II keyboards available later in the year — Phone for availability and price.

WE ARE NOW STOCKING THE AUTOSTART APPLE II AT REDUCED PRICES

16K £549 }
32K £579 } + VAT
48K £599 }

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built-in features like:

- BASIC — The Language that Makes Programming Fun.
- High-Resolution Graphics (in a 54,000-Point Array) for Finely-Detailed Displays.
- Sound Capability that Brings Programs to Life.
- Hand Controls for Games and Other Human-Input Applications.
- Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package.
- Eight Accessory Expansion Slots to let the System Grow With Your Needs.

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

APPLE DISC II 3.3 Dos

Disc with Controller £349 + VAT
Additional Drives £299 + VAT



- Powerful Disk Operating Software Supports up to 6 drives
- Name Access to Files for Ease of Use
- BASIC Program Chaining to Link Software Together
- Random or Sequential File Access to Simplify Programming
- Dynamic Disk Space Allocation for Efficient Storage
- Individual File Write-Protection Eliminates Accidental File Alterations
- Loads an 8K Byte Binary Image in 6.5 sec. (1.2 sec. in Pascal)
- Storage Capacity of 116 Kilobytes (143K Bytes with Pascal) on Standard 5 1/4" Diskettes
- Powered Directly From the APPLE (Up to 6 Drives) for Convenience and High Reliability
- Packaged in Heavy-Duty, Colour-Coordinated Steel Cabinet

SPECIAL SCOOP GET YOURSELF A NEW MX80 PRINTER AND SAVE A FORTUNE

only £299 + VAT

Interface Cards for Apple, Pet, TRS80, Nascom and Compukit — RS232 Interface Cards not necessary for parallel. £49 + VAT

Full TRS80/Genie Graphics



EX-STOCK

THE VIDEO GENIE SYSTEM

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.

EG3000 Series

WITH NEW EXTRA KEYS!

16K £279 + VAT

- 16K user RAM plus extended 12K Microsoft BASIC in ROM
 - Fully TRS-80 Level II software compatible
 - Huge range of software already available
 - Self contained, PSU, UHF modulator, and cassette
 - Simply plugs into video monitor or UHF TV
 - Full expansion to disks and printer
 - Absolutely complete — just fit into mains plug.
- The Video Genie is a complete computer system, requiring only connection to a domestic 625 line TV set to be fully operational; or if required a video monitor can be connected to provide the best quality display. 51 key typewriter style keyboard, which features a 10 key rollover. Supplied with the following accessories: • BASIC demonstration tape; • Video lead; • Second cassette lead; • Users manual; • BASIC manual; • Beginners programming manual. Write useful programs in the BASIC computer language yourself.



VIDEO GENIE EXPANSION BOX

Complete with RS232 interface and floppy disc controller. 0 memory. £225 + VAT.

Memory expansion card (S100) 16K £110 32K £159 + VAT
Further S100 cards available later in the year.

THE NEW ANADEX DP9500 and DP9501

A PROFESSIONAL PRINTER

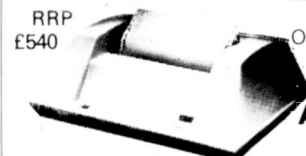


- Bi-directional printing
- Up to 220 chars/line with 4 print densities
- 500 char buffer
- RS232C and Centronics Parallel interface built in
- Full software control of matrix needles allowing graphics capability
- 200 chars/sec
- Adjustable width tractor feed.

DP9500 — ONLY £795 + VAT

DP9501 — ONLY £845 + VAT

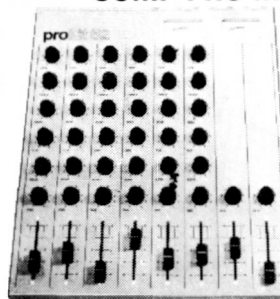
RRP £540



ANADEX DP8000

Super Quality — Low cost printer. Tractor Feed with full 96 ASCII character set. Accepts RS232C at band rates between 100 and 9600 and Parallel Bit data. Attaches either directly or through interfaces to Pet, Apple, TRS80, Sorcerer, Nascom, Compukit etc.

COMP PRO MIXER



Professional audio mixer that you can build yourself and save over £100.

Only £99.90 plus VAT for complete kit. Plus FREE power supply valued at £25.00

ACCESSIT AUDIO ADD-ONS

HITACHI PROFESSIONAL MONITORS

9" — £129 £99.95
12" — £199 £149

- Reliability Solid state circuitry using an IC and silicon transistors ensures high reliability.
- 500 lines horizontal resolution Horizontal resolution in excess of 500 lines is achieved in picture center.
- Stable picture Even played back pictures of VTR can be displayed without jittering.
- Looping video input Video input can be looped through with built-in termination switch.
- External sync operation (available as option for U and C types)
- Compact construction Two monitors are mountable side by side in a standard 19-inch rack.

TV GAME BREAK OUT

Has got to be one of the world's greatest TV games. You really get hooked. As featured in ETI. Has also 4 other pinball games and lots of options. Good kit for up-grading old amusement games.



MINI KIT — PCB, sound & vision modulator, memory chip and de-code chip. Very simple to construct. £14.90 + VAT
OR PCB £2.90 MAIN LSI £8.50 Both plus VAT

ENGLISH COLOUR TV/ AMERICAN NTSC COLOUR MONITOR

Suitable for Apple, Atari and Texas 99/4 £295 + VAT

NEC SPINWRITER

only £1390 + VAT



NEC's high quality printer uses a print "thimble" that has less diameter and inertia than a daisy wheel, giving a quieter, faster, more reliable printer that can cope with plotting and printing (128 ASCII characters) with up to five copies, friction or tractor fed. The ribbon and thimble can be changed in seconds. 55 characters per second bidirectional printing — with red/black, bold, subscript, superscript, proportional spacing, tabbing, and much, much more.

PANASONIC KX-T1520 AUTOMATIC TELEPHONE ANSWERING SYSTEM

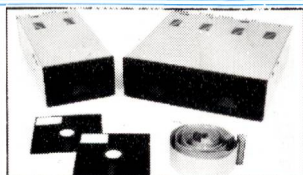
NOW AVAILABLE



£190
+ VAT

One of the most technically advanced telephone answering units available, the KX-T1520 features a double cassette system, a C60 cassette for incoming calls, which can be limited to 30 secs each or recorded in their entirety, and a 20 sec continuous loop cassette for your outgoing messages which are recorded through the built-in microphone. Your telephone conversations can also be recorded after a beep tone has notified your caller they are being taped. Incoming calls can be monitored and the ring control is adjustable.

The remote call-in pick-up with Playback/Reset/Repeat and Skip controls, activates the system to play back your messages to you over the phone wherever you are in the world.



TEAC DISK DRIVES

- TEAC FD-50A has 40 tracks giving 125K Bytes unfformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, TRS80, North Star Horizon, Superbrain, Nascom, etc, etc.
- Address selection for Daisy chaining up to 4 Disks.
- Disks plus power supply housed in an attractive grey case.

40 TRACK

Single Disk Drive **£225** + VAT Double Disk Drive **£389** + VAT

77 TRACK

Single Disk Drive **£299** + VAT Double Disk Drive **£499** + VAT

**WE HAVE ONE OF THE LARGEST
COLLECTIONS OF COMPUTER BOOKS
UNDER ONE ROOF, ALONG WITH
RACKS OF SOFTWARE FOR
THE GENIE AND TRS80.
COME AND SEE FOR YOURSELF.**

Illustrating Basic	3.90
Basic Handbook	11.00
6502 Software Gourmet Guide & Cookbook	8.50
Programming the 6502	9.20
6502 Assembly Language Programming	12.90
32 Basic Programs for the PET Computer	10.50
PET / CBM Personal Computer Guide	12.00
PET Revealed	10.00
Library of PET Subroutines	10.00
Apple II User's Guide	12.00
Beginner's Guide for the UCSD Pascal System	7.90
Z80 Microcomputer Handbook	7.50
Programming the Z80	10.60
TRS80 Basic: A Self-Teaching Guide	7.20
TRS80 Interfacing Book 1	7.50
TRS80 Interfacing Book 2	7.50
32 Basic Programs for the TRS80 Level II	10.50
Microsoft Basic Decoded & Other Mysteries	18.50
ZX80 Pocket Book	5.00
30 Programs for the Sinclair ZX80	7.00
Making the Most of Your ZX80	7.90

PLEASE ADD 40p P&P

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER COMPUKIT UK101

★ 6502 based system — best value for money on the market. ★ Powerful 8K Basic — Fastest around ★ Full Qwerty Keyboard ★ 4K RAM Expandable to 8K on board. ★ Power supply and RF Modulator on board. ★ No Extras needed — Plug-in and go ★ Kansas City Tape Interface on board. ★ Free Sampler Tape including powerful Disassembler and Monitor with each Kit. ★ If you want to learn about Micros, but don't know which machine to buy then this is the machine for you.



Build, Understand and Program your own Computer for only a small outlay.

NEW EXTENDED MONITOR IN EPROM — available separately at **£22** + VAT.
Improved Basic function — revised GARBAGE routine. Allows correct use of STRING ARRAYS.
This chip can be sold separately to existing CompuKit and Super board users.

FOR THE COMPUKIT — Assembler Editor **£14.90** Screen Editor Tape **£1.90**

GAME PACKS — 1). Four Games **£5.00** 2). Four Games **£5.00** 3). Three Games 8K only **£5.00**
Super Space Invaders (8K) **£6.50** Chequers **£3.00** Realtime Clock **£3.00**

Case for CompuKit **£29.50**

40 pin Expansion Jumper Cable **£8.50**

All Prices exclusive VAT

**NEW ISSUE COMPUKIT
WITH ALL THE FEATURES
THAT MADE IT THE MOST
PROFESSIONAL
COMPUTER KIT ON THE
MARKET. Now WITH FREE
NEW EXTENDED
MONITOR (a saving of £22),
which includes Flashing
Cursor, Screen Editing, &
Save Data on Tape.**

KIT ONLY **£149** + VAT

Fully Assembled — **£199** + VAT

DEALER ENQUIRIES INVITED

4K Upgrade Kit
£15.90 + VAT

YOUR ZX80 IS NOW NO LONGER REDUNDANT

Upgrade your ZX80 to the full animated graphics of the ZX81. (No screen flicker).

FOR ONLY **£12.95** + VAT IN KIT FORM

Works only in conjunction with **NEW 8K ROM** from Sinclair (Not Included).

**IF IT WASN'T FOR THE
LOWEST PRICES,
THE BIGGEST CHOICE
AND THE BEST
AFTER SALES SERVICE,
WE JUST WOULDN'T BE
COMP SHOP**



SHARP PC1211

£79.90
+ VAT

COMPUTER
POWER THAT
ONCE FILLED A ROOM
CAN NOW BE CARRIED IN YOUR POCKET!

- Programs in BASIC • "QWERTY" Alphabetic Keyboard • 1.9K Random Access Memory • Long Battery Life.

Computer power that once filled a room can now be carried in your pocket! It's easy to load with ready-to-run software from cassette tape (interface and recorder optional) or program it yourself in easy-to-learn BASIC. 24-character liquid crystal readout displays one line at a time. Special feature is advanced non-volatile memory allows you to power on and off without losing the contents of memory. Note: Memory must be transferred to tape before changing batteries. Automatic statement compaction squeezes every ounce of memory space. Features power-off retention of programs and data. Powerful resident BASIC language includes multiple statements, math functions, editing, strings, arrays and much more. Multiple program loading capability subject to RAM availability. Carrying case and batteries included.



FANTASTIC FOR FILE HANDLING ACULAB FLOPPY TAPE

The tape that behaves like a disc, for TRS-80 LEVEL 2.

only **£169** + VAT

The Aculab Floppy Tape for the TRS-80 and Video Genie is a highly reliable digital storage system that provides many of the advantages of floppy disks at less cost. Automatic debounce routine for the Level 2 keyboard.

Connects directly to TRS-80 Level 2 Keyboard. Operating and file handling software in ROM. 8 commands add 12 powerful functions to Level 2 BASIC.

8MHz Super Quality Modulators	£4.90
6MHz Standard Modulators	£2.90
C12 Computer Grade Cassettes	10 for £4.00
Anadex Printer Paper — 2000 sheets	£15.00
Floppy Discs 5 1/4" Hard and Soft Sector	£2.90
Floppy Disc Library Case 5 1/4"	£3.50
Ribbons DP8000	£3.50
DP9500/9501	£12.50

PLEASE ADD 15% V.A.T.

WE give a full one year's guarantee on all our products, which normally only carry 3 months guarantee.

**A SELECTION OF APPLE INTERFACES
ARE NOW AVAILABLE AT OUR
EDGWARE ROAD SHOWROOM**

**ATARI CARTRIDGES
IN STOCK**
Phone for availability

SALE MEMORY UPGRADES
16K (8 x 4116) **£15.90** + VAT
4K CompuKit (8 x 2114) **£15.90** + VAT

**COMP
SHOP**
"Europe's Largest Discount
Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMP SHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.

MAIL ORDER AND SHOP:

CREDIT FACILITIES ARRANGED — send S.A.E. for application form.

14 Station Road, New Barnet, Hertfordshire, EN5 1QW (Close to New Barnet BR Station — Moorgate Line).

Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G

OPEN (BARNET) — 10am - 7pm — Monday to Saturday

NEW WEST END SHOWROOM:

311 Edgware Road, London W2. Telephone: 01-262 0387

OPEN (LONDON) — 10am - 6pm — Monday to Saturday

★ **IRELAND:** 80 Marlborough Street, Dublin 1. Telephone: Dublin 749933

★ **COMP SHOP USA,** 1348 East Edinger, Santa Ana, California, Zip Code 92705.
Telephone: 0101 714 5472526



TELEPHONE SALES

OPEN 24 hrs. 7 days a week

01-449 6596

We are now entering our fourth financial year of dealing solely in the personal computer market — in fact, we started it! Over this period, Personal Computers Limited have formed a group of graduate specialists who will help you in the fields of word processing, financial planning, statistics, economic modelling, forecasting, accounting systems, foreign exchange, banking and oil exploration.

We also do rather well with computer graphics and highly recommend the graphics tablets and our plotter for Apple.

We can also offer two excellent items of software — Format 40 and Visicalc — at a combined price of ONLY £189, and the Super Sound Generator for only £90! (excl. V.A.T.)



8" Disk Drive (above left)

Our 8" disks are still as popular as ever — 2 drives give you 1.2MB with all the reliable security of Shugart Technology. Easily interfaced to Apple, uses the same D.O.S.

A.I.O. Serial and Parallel Card (above centre)

Three hand-shake lines (R.T.S., C.T.S. and D.C.D.). Firmware for serial interfaces on-board, software for parallel printer available, 2 bi-directional 8 bit parallel ports, plus 4 additional interrupt and hand-shaking lines.

Light Pen (above right)

A much sought after product which we introduced to the U.K.

80 Character Card (below left)

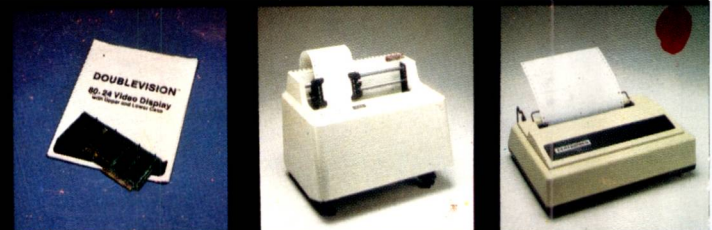
... opens up the real commercial world for all Apple owners.

Paper Tiger (Below centre)

132 character line, plus graphics, 8 character sizes, ordinary paper, multiple copy, upper and lower case 96 character, parallel/serial, form control.

Centronics 730 (Below right)

A substantial, robust printer from a major manufacturer. 3 way paper handling system, 100 character per second. Special low-cost including interface. 96 characters.



Items pictured

Sharp MZ — 80K

A new generation of personal computer, self contained, versatile and starting at only £570 (excl. VAT). Explore the Zilog Z80 now the easy way. Disks and printer available shortly.

Numeric Keypad

... with 8 function keys is a must in all financial applications.

TCM 100 & TCM 200

... both now have graphics as well as their own power supply, essential with this type of printer.

Qume Sprint 5

The quality word processing printer. Clean, clear executive reports the way you want them. Can print up to 5760 points per square inch — or even print in 2 colours.

This is what we do...

and we do it rather well!



Personal Computers Limited

194-200 Bishopsgate, London EC2M 4NR. Tel. 01 626 8121

For further information, please complete this coupon and post to:
Personal Computers Limited, 194-200 Bishopsgate, London EC2M 4NR

NAME _____ ADDRESS _____

* Now here details
APPLE

PCW 7/81